

AC 800M

Foundation Fieldbus HSE

System Version 6.0

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System Version 6.0

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About This User Manual



Any security measures described in this User Manual, for example, for user access, password security, network security, firewalls, virus protection, etc., represent possible steps that a user of an 800xA System may want to consider based on a risk assessment for a particular application and installation. This risk assessment, as well as the proper implementation, configuration, installation, operation, administration, and maintenance of all relevant security related equipment, software, and procedures, are the responsibility of the user of the 800xA System.

This book describes the configuration of control applications with FOUNDATION Fieldbus HSE using the CI860 module along with HSE Linking Devices and Fieldbus Builder FOUNDATION Fieldbus as FOUNDATION Fieldbus configuration tool.

The main areas covered in this document are:

- Requirements for setting up a FOUNDATION Fieldbus HSE system.
- System and network structures.
- Hardware configuration with the Control Builder.
- Application programming and dedicated FOUNDATION Fieldbus function blocks and control modules.
- Engineering FOUNDATION Fieldbus applications in the control system.
- Commissioning the control system and the FOUNDATION Fieldbus.
- Supervision and status visualization of FOUNDATION Fieldbus.

The reader of this document is expected to have good knowledge of the 800xA control system and the FOUNDATION Fieldbus in general.

This book is not the only source of instruction for FOUNDATION Fieldbus. ABB offers training courses for those who use ABB control systems.

Intended User

This manual is intended for application engineers and for engineers who are planning the design of FOUNDATION Fieldbus HSE and H1 networks. The reader should be familiar with Control IT for AC 800M products and the programming tool, Control Builder. Also the reader should be familiar with the hardware and software functionality of the 800xA system products. Apart from this, the user should have a good FF knowledge, and knowledge about the Fieldbus Builder FOUNDATION Fieldbus and the OPC Server FOUNDATION Fieldbus.

How to Use This Book

[Section 1, Introduction](#) provides a brief overview of FOUNDATION Fieldbus and how it is integrated in the controllers.

[Section 2, Functional Description](#) provides detailed information on the FF HSE implementation.

[Section 3, Configuration](#) describes the configuration of FOUNDATION Fieldbus HSE with the Control Builder and the interaction with the Fieldbus Builder FF.

[Section 4, Download and Online Mode](#) describes how to download and go online with a project accessing FOUNDATION Fieldbus data.

[Section 5, Configuration Changes](#) provides informations and describes how to handle configuration changes in Fieldbus Builder FF and Control Builder. Changes should be taken with care.

[Section 6, CI860 Webserver](#) provides a detailed diagnostic information from the system in Fieldbus Builder FF and Control Builder.

[Appendix A, Application Example](#) provides a brief overview on a sample application.

[Appendix B, CI860 Error Codes](#) provides a C1860 error codes.

For a list of documentation related to the products described in this book, see [Released User Manuals and Release Notes](#) on page 13.

User Manual Conventions

Microsoft Windows conventions are normally used for the standard presentation of material when entering text, key sequences, prompts, messages, menu items, screen elements, etc.

Warning, Caution, Information, and Tip Icons

This User Manual includes Warning, Caution, and Information where appropriate to point out safety related or other important information. It also includes Tip to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:



Electrical warning icon indicates the presence of a hazard that could result in *electrical shock*.



Warning icon indicates the presence of a hazard that could result in *personal injury*.



Caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in *corruption of software or damage to equipment/property*.



Information icon alerts the reader to pertinent facts and conditions.



Tip icon indicates advice on, for example, how to design your project or how to use a certain function

Although Warning hazards are related to personal injury, and Caution hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, fully comply with all Warning and Caution notices.

Terminology

A complete and comprehensive list of terms is included in the *System 800xA, Engineering Concepts instruction (3BDS100972*)*. The listing includes terms and definitions that apply to the 800xA System where the usage is different from commonly accepted industry standard definitions and definitions given in standard dictionaries such as Webster's Dictionary of Computer Terms. Terms that uniquely apply to this User Manual are listed in the following table.

The table below contains terms that uniquely apply to this instruction.

Term/Acronym	Description
Application Process (AP)	Application Process (AP) is a term defined by the International Standards Organization (ISO) Open Systems Interconnect (OSI) Reference Model (RM), ISO 7498, to describe the portion of a distributed application that is resident in a single device. The term has been adapted for the fieldbus environment to describe entities within devices that perform a related set of functions, such as function block processing, network management, and system management. Refer to Function Block Application Process (FBAP).
FOUNDATION Fieldbus Network	Refer to FF Network.
FF Network	A FOUNDATION Fieldbus network is comprised of one HSE subnets and one or more interconnected H1 links.
Function Block Application Diagram (FBAD)	The Function Block Application Diagram includes function blocks and signal linkages between them.
Function Block Application Process (FBAP)	A Function Block Application Process (FBAP) is that part in the software of a device which contains the Function Blocks and executes the Function Block Application. The FBAP is organized as separate VFD.
H1 Link	An H1 link interconnects one or more H1 Devices.

Term/Acronym	Description
HSE Subnet	HSE Subnets are IP networks. They are permitted to contain bridges, but not routers. The HSE Subnet is used to qualify the Link Id. The combination of the HSE Subnet and the Link Id is unique across all HSE Subnets of a system. An HSE subnet consists of one or more HSE devices connected via Ethernet. HSE devices on a subnet may be interconnected with standard switches. Multiple HSE subnets may be interconnected using standard routers.
Physical Device (PD)	The term references the real field device as opposed to a Virtual Field Device (VFD).
ICMP	Internet Control Message Protocol.

Released User Manuals and Release Notes

A complete list of all User Manuals and Release Notes applicable to System 800xA is provided in *System 800xA Released User Manuals and Release Notes (3BUA000263*)*.

System 800xA Released User Manuals and Release Notes (3BUA000263)* is updated each time a document is updated or a new document is released. It is in pdf format and is provided in the following ways:

- Included on the documentation media provided with the system and published to ABB SolutionsBank when released as part of a major or minor release, Service Pack, Feature Pack, or System Revision.
- Published to ABB SolutionsBank when a User Manual or Release Note is updated in between any of the release cycles listed in the first bullet.



A product bulletin is published each time *System 800xA Released User Manuals and Release Notes (3BUA000263*)* is updated and published to ABB SolutionsBank.

The table below contains documentation that additionally apply to this instruction.

Title	Description
FOUNDATION Fieldbus Technical Overview FD-043 Publisher: Fieldbus Foundation, 2003	Definition and explanation of key technical concepts inherent in FOUNDATION Fieldbus technology. ⁽¹⁾
FOUNDATION Fieldbus System Engineering Guidelines AG-181 Publisher: Fieldbus Foundation, March 2010	Guideline reflecting standard industry practices for the application of FOUNDATION Fieldbus H1 projects. ⁽¹⁾
FOUNDATION Fieldbus Web Site - FIELDBUS ONLINE (www.fieldbus.org)	Standards and commercially available FOUNDATION Fieldbus documentation.
3BDD012902*_FF_Config	How to use the Fieldbus Builder FF.
3BDD011677*_FF_LD800HSE	Documentation of the HSE/H1 Linking Device LD 800 HSE

(1) The document can be downloaded from the Fieldbus Foundation's website:
<http://www.fieldbus.org/ProductsAndServices/FFProductCatalog/>

Section 1 Introduction

FOUNDATION Fieldbus (FF) is a fieldbus protocol based on international standards and designed for applications in the manufacturing industry, process automation and buildings automation. The Fieldbus Foundation publishes the guidelines for this fieldbus standard.

FF defines two communication profiles, H1 and HSE. The H1 profile allows a transmission rate of 31.25 kbit/s. It is preferably used for direct communication between field devices in one link (H1 link). The HSE profile with a transmission rate of 10 or 100 Mbit/s serves as a powerful backbone for the link between H1 segments and allows the integration of high speed controllers (such as PLC or DCS). The communication between the field devices on the H1 segments and the HSE backbone is realized by FF Linking Devices (e.g. LD 800HSE) which act as gateway between the H1 and the HSE profiles.

The FOUNDATION Fieldbus is linked to the AC 800M via the high-performance HSE bus using HSE Host CI860 devices. This HSE Host CI860 module and its configuration is the main topic of this documentation. It performs a data type transfer from FF data types to IEC 61131 data types of the AC 800M and vice versa and organizes the data transfer from the FF HSE Subnet to the Control Network of the 800xA system.

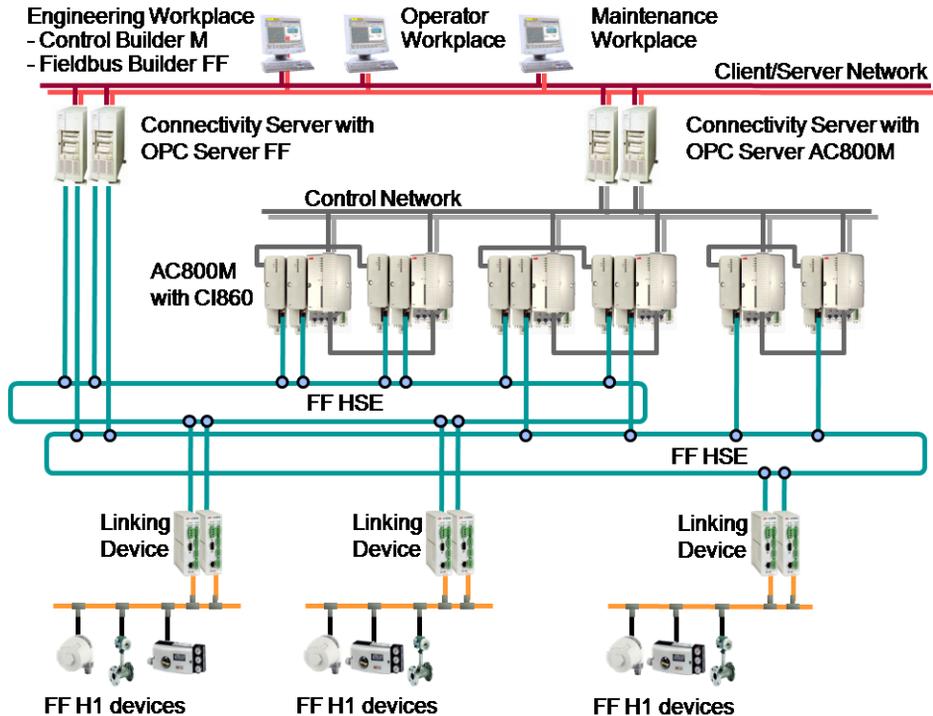


Figure 1. System 800xA topology with FF HSE

Figure 1 shows the system 800xA topology including two FF HSE Subnets. The Engineering, the Operator and the Maintenance Workplaces are connected to the Client Server Network. A (redundant) Connectivity Server AC 800M (OPC server AC 800M) connects the Client Server Network to a Control Network. A (redundant) Connectivity Server FF (OPC server FF) connects the Client Server Network to the HSE subnets. (Redundant) AC 800M controllers are connected to the Control Network, (redundant) CI860 modules connect the controllers to the HSE subnets.

The FF subsystem consists of FF Linking Devices (LD) and FF H1 devices (sensors, actuators). It is interfaced to the IEC 61131 controller (AC 800M) using the CI860 module in the AC 800M.

FF Linking Devices operate as gateways between the HSE Subnet and the field devices on the H1 segments. One ABB FF Linking Device LD 800HSE provides four FOUNDATION Fieldbus H1 links. The FF Linking devices communicate with one another by using the HSE protocol. It is a devices according class 42c which allows process data that have been published cyclically on the subsidiary H1 segments to be “republished” on the HSE segment. By using HSE republishing, it is possible to configure communication between field devices on different H1 segments and devices on the HSE segment.

All FF HSE Subnet components supports redundancy. This includes the communication interface module CI860, the Linking Device LD 800HSE, the OPC-Server FF and the HSE Subnet itself.

A control application can be distributed over AC 800M controllers and FF devices. Configuration is performed using the Plant Explorer with the use of two aspect systems, Fieldbus Builder FOUNDATION Fieldbus (Fieldbus Builder FF) and Control Builder. The Fieldbus Builder FF is used for configuration of the FF application (this includes the FOUNDATION Fieldbus HSE, the H1 networks, the FF devices and the CI860). The Control Builder is used for configuration of the IEC 61131 application.

The variables defined in the IEC 61131 applications are mapped to FF signals connected to FF function blocks in FF devices. In the Control Builder these FF signals are represented as IO channels which are handled by the CI860 module. This data exchange is cyclic and called Publisher/Subscriber communication. Further it is possible to access FF block contained parameters from the IEC 61131 application. This data exchange is acyclic and called Client/Server communication.

General

- Multiple HSE subnets may be connected to an 800xA system.
- The CPU module of the AC 800M controller must be connected to the Control Network.
- The FOUNDATION Fieldbus HSE Communication Interface Modules CI860 in the AC 800M controller must be connected to an HSE subnet.
- Up to twelve FOUNDATION Fieldbus HSE Communication Interface Modules CI860 may be connected to one AC 800M controller.
- The FOUNDATION Fieldbus HSE Communication Interface Module CI860 may be used in redundant controllers and it supports module redundancy.
- The Linking Device LD 800HSE connects H1 links to an HSE subnet. The LD 800HSE can be used in redundant configuration.
- FOUNDATION Fieldbus HSE subnets should be physically separated from other networks as FOUNDATION Fieldbus HSE multicasts cause high load on the network.
- OPC Server FF provides tool routing functionality.
 - The Connectivity Server(s) running OPC Server FF are required to provide tool routing functionality for the workplaces running Fieldbus Builder FF so that these can access the FF subnet(s)

Components

Figure 1 lists the components with the description.

Table 1. Components

Component	Description
Client Server Network	Network to which engineering and operator workplaces as well as servers are connected.
Engineering Workplace	800xA engineering workplace running Control Builder and/or Fieldbus Builder FF.

Table 1. Components

Component	Description
Maintenance Workplace	Basically a plant explorer workplace which provides a user interface for maintenance personnel. This workplace has an alarm band that shows asset monitoring alarms for default asset groups
Fieldbus Builder FF	Fieldbus Builder FOUNDATION Fieldbus, Engineering Tool for Configuration and Commissioning of FOUNDATION Fieldbus networks including H1 and HSE.
Control Builder	Engineering tool for configuration of AC 800M hardware and applications
Operator Workplace	800xA operator workplace for process visualization and operation
Connectivity Server FF	Connectivity server running OPC Server FF.
OPC Server FF	OPC Server for FOUNDATION Fieldbus.
Connectivity Server AC 800M	Connectivity server running OPC Server for AC 800M
Control Network	10 Mbit/s Ethernet Network used to connect controllers, operator stations, engineering workplaces, servers, etc.
AC 800M	AC 800M controller: Hardware platform to which individual hardware modules may be connected and which, depending on the specific module configuration and operating system selected, can be programmed to perform multiple functions
CI860	FOUNDATION Fieldbus HSE Communication Interface Module CI860 for the AC 800M controller.
LD 800HSE	FOUNDATION Fieldbus Linking Device LD 800HSE. Gateway between four FF H1 Links and FF HSE suited for redundant use.

Table 1. Components

Component	Description
HSE	FOUNDATION Fieldbus High Speed Ethernet (HSE) protocol, used as backbone network. Typically running at, but not being limited to 100 Mbit/second Ethernet.
H1	FOUNDATION Fieldbus H1 protocol using 31.25 kbit/s network physics.

Section 2 Functional Description

FOUNDATION Fieldbus supports the following communication types to access FF data.

- The communication type **Publisher/Subscriber** is used for a buffered 1-to-m communication. Buffered means that only the most recent data is available on the network; new data overrides the old data. This connection type is used by the field devices for the cyclical time-controlled publishing of function block inputs and outputs. The control loop signals exchanged between the field devices, for example, use this connection type.
- The communication type **Client/Server** is used for user-initiated, non-cyclical 1-to-1 communication between devices. Typical examples of this connection type are communication set point changes, user acknowledgements of messages and the downloading or reading back of device configuration data.
- The communication type **Source/Sink** is used for a user application-initiated, non-cyclical 1-to-n communication. For example, following a request by the LAS a device with a configured trend report will send the trend report to the group address defined for the purpose. Another typical use of this connection type is the sending of process alarms to the operator consoles.

Publisher/Subscriber Communication

Control Builder and AC 800M allow for access to FF signals communicated by Publisher/Subscriber communication via CI860. Thereby access to FF function block inputs and outputs being connected to an FF signal in Fieldbus Builder FF and being published or subscribed is possible. Only FF data types DS-65 and DS-66 are supported for Publisher/Subscriber communication.

Data Types

The CI860 contains a fixed number of channels of the four different channel types. AnalogIn (IW), AnalogOut (QW), DiscreteIn (IX), and DiscreteOut (QX). The analog FF data type DS-65 is mapped to the RealIO data type of the AC 800M, the discrete FF data type DS-66 can contain binary information but also up to 256 states (one byte). For these different usages two AC 800M data types can be mapped to the discrete FF signal: The BoolIO for binary usage and the DwordIO for the full usage of all possible values. The CI860 provides these two possibilities for a discrete channel. For discrete outputs only one of the available IO data types (BoolIO or DwordIO) can be used for the same channel at the same time, but different channels in the discrete section can be used with the different IO data types.

Table 2. Data Types of Publisher/Subscriber Communication

CI860 channel type	FF data type	Is mapped to data type of the AC 800M
IWx.x	FF DS-65	RealIO
IXx.x	FF DS-66	BoolIO DwordIO
QWx.x	FF DS-65	RealIO
QXx.x	FF DS-66	BoolIO DwordIO

FF Status Handling

FF signals contain value and status information. [Figure 2](#) and [Figure 3](#) show how the FF specific status information is handled in the CI860. As mentioned before, the

CI860 has IO channels with the data types RealIO, BoolIO and DwordIO. The status of these types are referenced as Channel IO Status

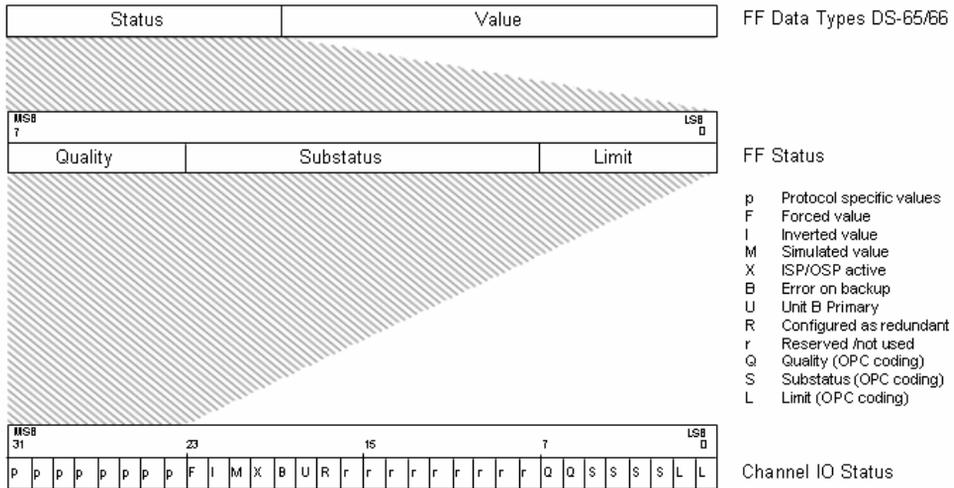


Figure 2. Status Handling for Inputs

For inputs the FF status is copied to the Bits 31-24 of the Channel IO status. For example the status of the FF devices is copied to the first Byte of the RealIO, BoolIO, and DwordIO data types (see Figure 2).

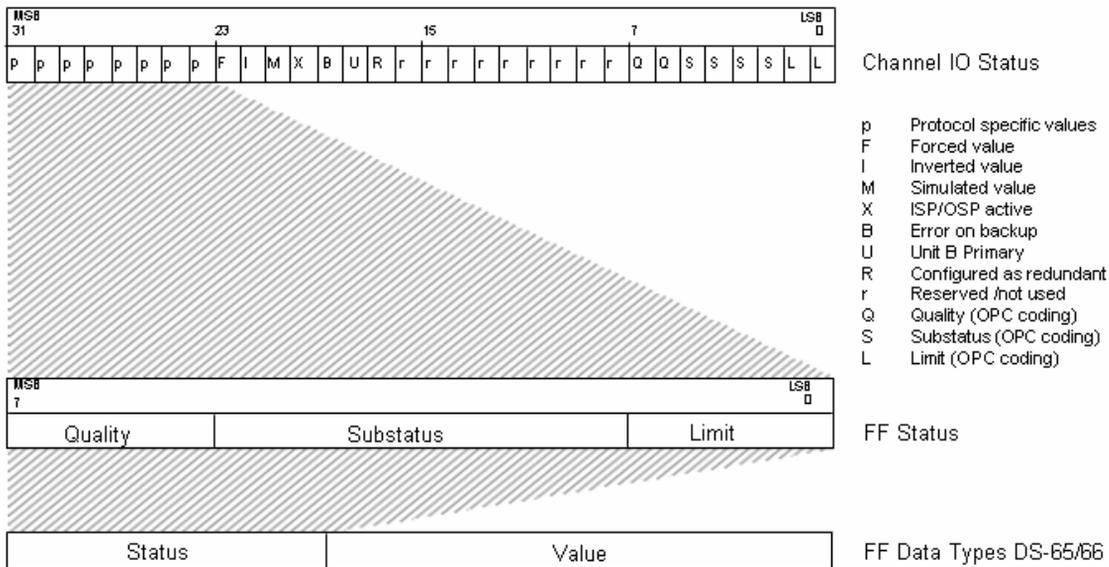


Figure 3. Status Handling for Outputs

For outputs the FF status is copied from Bits 31-24 from the Channel IO status. For example the status information is copied from the first Byte of the RealIO, BoolIO, and DwordIO data types (see [Figure 3](#)).

Overview FF Signal Status

The status value of a Foundation Fieldbus signal can be split into Quality, Substatus and Limit (see [Figure 4](#)). In Control Builder this FF Signal status can be accessed via the first byte of the Channel IO status (see [Figure 2](#) and [Figure 3](#)).

Quality		Substatus				Limits	
2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰

Figure 4. FF Signal Status Byte

Quality

For the Quality of one FF Signal four values are possible (see [Table 3](#)).

Table 3. Definition of Quality in FF Status Byte

Quality	Bit value	Define	Description
0	00SSSSL	Bad	Value is not useful for reasons indicated by the Substatus
1	01SSSSL	Uncertain	The quality of the value is uncertain for reasons indicated by the SubStatus.
2	10SSSSL	Good (Non-cascade)	The quality of the value is good, but possible alarm conditions may be indicated in the substatus
3	11SSSSL	Good (Cascade)	The value may be used in control.

Substatus

Each Quality has a set of up to 16 possible Substatus (see [Table 4](#) to [Table 7](#)).

Table 4. Definition of FF signal Substatus for Quality: Bad

Substatus	Bit value	Hex value	Define
0	000000LL	0x00	Non specific
1	000001LL	0x04	Configuration Error
2	000010LL	0x08	Not connected
3	000011LL	0x0c	Device Failure
4	000100LL	0x10	Sensor Failure
5	000101LL	0x14	No Communication, with last usable value
6	000110LL	0x18	No Communication, with no usable value
7	000111LL	0x1c	Out of Service
8-15			Not used

Table 5. Definition of FF signal Substatus for Quality: Uncertain

Substatus	Bit value	Hex value	Define
0	010000LL	0x40	Non specific
1	010001LL	0x44	Last Usable Value
2	010010LL	0x48	Substitute
3	010011LL	0x4c	Initial Value
4	010100LL	0x50	Sensor Conversion not Accurate
5	010101LL	0x54	Engineering Unit Range Violation
6	010110LL	0x58	Sub normal
7-15			Not used

Table 6. Definition of FF signal Substatus for Quality: Good (Non-cascade)

Substatus	Bit value	Hex value	Define
0	100000LL	0x80	Non specific
1	100001LL	0x84	Active Block Alarm
2	100010LL	0x88	Active Advisory Alarm
3	100011LL	0x8c	Active Critical Alarm
4	100100LL	0x90	Unacknowledged Block Alarm
5	100101LL	0x94	Unacknowledged Advisory Alarm
6	100110LL	0x98	Unacknowledged Critical Alarm
7-15			Not used

Table 7. Definition of FF signal Substatus for Quality: Good (Cascade)

Substatus	Bit value	Hex value	Define
0	110000LL	0xc0	Non specific
1	110001LL	0xc4	Initialization Acknowledged (IA)
2	110010LL	0xc8	Initialization Request (IR)
3	110011LL	0xcc	Not Invited (NI)
4	110100LL	0xd0	Not selected (NS)
6	110110LL	0xd8	Local Override (LO)
7	110111LL	0xdc	Fault State Active (FSA)
8	111000LL	0xe0	Initiate Fault State (IFS)
5, 9-15			Not used

Limits

The last two Bits of the FF Status Byte are used to indicate the limit of the signal. These bits are valid regardless the Quality and the Substatus

Table 8. Definition of Limit in FF signal status

Limit	Bit value	Define	Description
0	QQSSSS00	Not limited	The value is free to move
1	QQSSSS01	Low limited	The value is from a block that cannot generate or use a lower value because it is limited in that direction
2	QQSSSS10	High limited	The value is from a block that cannot generate or use a higher value because it is limited in that direction
3	QQSSSS11	Constant	The value cannot move, no matter what the process does

Overview CI860 IO Status

The IO Status provides informations of the IOs from the CI860 module. It can be accessed in Control Builder via the last byte of the Channel IO status (see [Figure 2](#)). The IO Status byte has the same structure as the status value of a Foundation Fieldbus signal. It can be split into Quality, Substatus and Limit (see [Figure 4](#)).

Quality

For the Quality of the IO Status four values are possible (see [Table 9](#)).

Table 9. Definition of Quality in IO Status Byte

Quality	Bit value	Define	Description
0	00SSSSL	Bad	Value is not useful for reasons indicated by the Substatus
1	01SSSSL	Uncertain	The quality of the value is uncertain for reasons indicated by the SubStatus.
2	10SSSSL	Not used	
3	11SSSSL	Good (Cascade)	The value may be used in control.

Substatus

Each Quality has a set of up to 16 possible Substatus (see [Table 10](#) to [Table 12](#)).

Table 10. Definition of IO Substatus for Quality: Bad

Substatus	Bit value	Hex value	Define	Description
0-2			Not used	
3	000011LL	0x0c	Unit error	A device failure has been detected. IO-value will be frozen to the last known value.
4	000100LL	0x10	Channel error	A channel error has been detected. IO-value will be frozen to the last known value. Additional information could be given in the Limit field, like HighHigh and LowLow.

Table 10. Definition of IO Substatus for Quality: Bad (Continued)

Substatus	Bit value	Hex value	Define	Description
8	001000LL	0x20	Not Initialized	The device is in initialization mode. IO-value will be frozen to the last known value. The value is not updated.
5,7,9-15			Not used	

Table 11. Definition of IO Substatus for Quality: Uncertain

Substatus	Bit value	Hex value	Define	Description
0-4			Not used	
1	010001LL	0x44	Last Usable Value	The value has not been updated and should be regarded as old.
5	010101LL	0x54	Engineering Units Exceeded	The value is outside the limits defined for this parameter. Limit field indicates which limit has been exceeded but does not necessarily imply that the value cannot move farther out of range.
6-15			Not used	

Table 12. Definition of IO Substatus for Quality: Good (Cascade)

Substatus	Bit value	Hex value	Define	Description
0-5			Not used	
6	110110LL	0xd8	Local Override	The value has been Forced
7-15			Not used	

Limits

The last two Bits of the IO Status Byte are used to indicate the limit of the signal. These bits are valid regardless the Quality and the Substatus

Table 13. Definition of Limit in FF Status Byte

Limit	Bit value	Define	Description
0	QQSSSS00	Not limited	The value is free to move up or down
1	QQSSSS01	Low limited	The value has 'pegged' at some lower limit.
2	QQSSSS10	High limited	The value has 'pegged' at some higher limit.
3		Not used	

Client/Server Communication

Client/Server communication is mainly used via OPC Server FOUNDATION Fieldbus. This allows access to FF function block parameters.

Additional Client/Server communication is also used via CI860 to allow acyclic access to FF block contained parameter from AC 800M controller.

The FF data types listed in [Table 14](#) can be communicated.

Data Types

Table 14 gives an overview about the supported FF data types for the Client/Server communication via CI860 and to which data types in the AC 800M controller they can be mapped.

Table 14. Data Types of Client/Server Communication

FF Data Type	Description	Mapped to data type of AC 800M
Float DS-8	Float value	FFFloatDS8
Bit String DS-14	Bit String value	FFBitStrLen8DS14 FFBitStrLen16DS14
Value & Status - Floating Point Structure DS-65	Float status and value	FFFloatStatusDS65
Value & Status - Discrete Structure DS-66	Discrete status and value	FFDiscreteStatusDS65

Source/Sink Communication

This communication type is used by OPC Server FF.

Dimensioning Guidelines

This subsection gives information about the physical and the performance limitations of the FF HSE communication interface module CI860 with subject to the FF communication types. For further information about technical data and performance limitation of the 800xA system, refer to following documents:

- *System 800xA System Guide Technical Data and Configuration (3BSE041434*)*.
- *Device Management FOUNDATION Fieldbus Linking Device LD 800HSE, User Instructions, (3BDD011677*)*

FF HSE Communication Interface CI860

The following limitations and calculations obtain to one CI860 module. One AC 800M controller supports up to twelve CI860 modules.

Physical Limits of Publish/Subscriber and Client/Server communication

- Cyclic communication via publish/subscribe:
In Control Builder, variables can be mapped to CI860 channels. Analog channels are mapped to the RealIO data type whereas discrete channels can be mapped to BoolIO and DwordIO data types. The number of CI860 channels to which variables can be mapped is limited to the following numbers:
 - 1000 channels of RealIO type for analog inputs.
 - 500 channels of RealIO type for analog outputs.
 - 500 channels of BoolIO type and 500 channels of DwordIO type for discrete inputs.
 - 500 channels in total for discrete inputs of type BoolIO or DwordIO.
 - 250 channels in total for discrete outputs of type BoolIO or DwordIO.The overall number of channels is limited to 1000.

- Acyclic communication via client/server:
In Control Builder it is possible to access acyclically to contained FF function block parameters. This is done via client/server communication through CI860. Following limitations have to be considered per CI860:
 - to maximum 30 Linking Devices can be communicated
 - to maximum 150 H1 devices and
 - with maximum 300 client/server signals.

Performance Limits of Publish/Subscriber communication

The CI860 can handle a maximum of 1000 VCRs, for example 1000 connections to I/O channels can be handled and therefore 1000 FF signals can be communicated with the CI860.

To ensure a proper functionality under all conditions the CPU load of the CI860 shall not exceed 80% at a maximum. This gives the limit of the Average FF load of 100% that can be operated by the CI860 during runtime.

$$\text{Average FF Load} = \text{CPU Load} * 1.25$$

The Average FF load is calculated and monitored by Fieldbus Builder FF depending on the actual configuration.

The CPU Load is given as Summery of the CPU Load for Publish/Subscribe (P/S) communication, the CPU Load for Client/Server (C/S) communication, and 9% idle load.

$$\text{CPU Load} = \text{CPU_Load_P/S} + \text{CPU_Load_C/S} + 9\% \text{ Idle Load}$$

Calculating CPU Load for P/S

$$\text{CPU_Load_P/S} = T * 0.105\% + N * 0.015\%$$

N: Number of configured channels on CI860

T: Number of transfers/sec (publish and subscribe)

Use the following formula for calculating T if number of cycles are used:

$$T = N_1/C_1 + N_2/C_2 + \dots + N_n/C_n$$

N: Number of configured channels on CI860

C: Used Signal Cycle time in [sec] for these channels



The formula accuracy is about +-5%.

Calculating CPU Load for C/S

$$\text{CPU_Load_C/S} = R/C * 1.6\%$$

R: Number of client/server requests

C: Cycle time of C/S requests in [sec]

Use the following formula for calculating CPU_Load_C/S if number of cycles are used:

$$\text{CPU_Load_C/S} = (R_1/C_1 + R_2/C_2 + \dots + R_n/C_n) * 1.6\%$$



The formula accuracy is about +-20%.

Verify the CI860 CPU load within Control Builder M, CI860 Hardware Configuration Editor in the Connections tab, diagnostic channel IW1.6502 CPU load and IW1.6505 Average FF load over a period of time when C/S requests were performed.

Table 15. Average FF Load Calculation Examples

Average FF Load Calculation Examples		
500 P/S signals with 1 sec cycle time	CPU_Load_P/S	60%
7 C/S signals with 1 sec cycle time	CPU_Load_C/S	+11%
Idle Load		+9%
CPU Load		80%
(Average FF Load = 100%)		
300 P/S signals with 1 sec cycle time	CPU_Load_P/S	36%

Table 15. Average FF Load Calculation Examples

Average FF Load Calculation Examples		
22 C/S signals with 1 sec cycle time	CPU_Load_C/S	+35%
Idle Load		+9%
CPU Load		80%
(Average FF Load = 100%)		

Section 3 Configuration

This section describes the configuration of FOUNDATION Fieldbus HSE with the Control Builder and the interaction with the Fieldbus Builder FF.

The FF configuration involves the following steps. It is assumed that the Plant Explorer Workplace, Control Builder and Fieldbus Builder FF are installed. A system is running.

1. Configure your networks, for example the Client Server Network, the Control Network and HSE Subnets. Refer to *System 800xA Network Configuration (3BSE034463*)*.
2. Configure the AC 800M controller hardware. This includes the configuration of the FOUNDATION Fieldbus HSE Communication Interface Module CI860. Refer to [Configuration in Control Builder](#) on page 45
3. Configure an HSE subnet. Refer to *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)*.
4. Configure the FF network topology. Refer to *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)*.
 - LD 800HSE Linking Device configuration.
 - FF HSE Host CI860 object configuration.
 - H1 Link configuration.
 - H1 Device configuration.
 - FF Function Block Application configuration.
5. Configure your Control Builder application(s). Refer to [Application Programming](#) on page 55.
6. Connect an HSE subnet. Refer to [Connect CI860 to the HSE Subnet](#) on page 50

7. Commissioning the HSE subnet. Refer to *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)*.
8. Going Online. Refer to [Section 4, Download and Online Mode](#).

Introduction of Configuration Tools

The configuration of Foundation Fieldbus is done from Plant Explorer Workplace with use of the two aspect systems Fieldbus Builder FOUNDATION Fieldbus (Fieldbus Builder FF) and Control Builder.

Fieldbus Builder FOUNDATION Fieldbus

The Fieldbus Builder FF is used for configuration and commissioning of the FF networks (this includes the FF HSE subnets, the H1 links, the FF devices, the FF applications running in the H1 devices and the HSE Host CI860). All signals which should be used in a IEC 61131 controller like the AC 800M have to be referenced to a dedicated HSE Host CI860 object out of Fieldbus Builder FF. The HSE Host CI860 object will be connected to CI860 module of the AC 800M controller (refer to [Connect CI860 to the HSE Subnet](#) on page 50). The Fieldbus Builder FF acts as an integrated application within the Industrial IT 800xA environment.

Control Builder

The Control Builder is used to do the IEC 61131 application programming as well as to configure and load the AC 800M controller and its communication interfaces (e.g. the CI860 module).

Network Configuration

This section describes additional network configurations and settings of the components which are needed for the integration of FOUNDATION Fieldbus in an 800xA system (this includes Fieldbus Builder FF, OPC Server FF, AC 800M, CI860 and the Linking Device). If the configuration is described detailed in other manuals the appropriate documentation will be referenced.

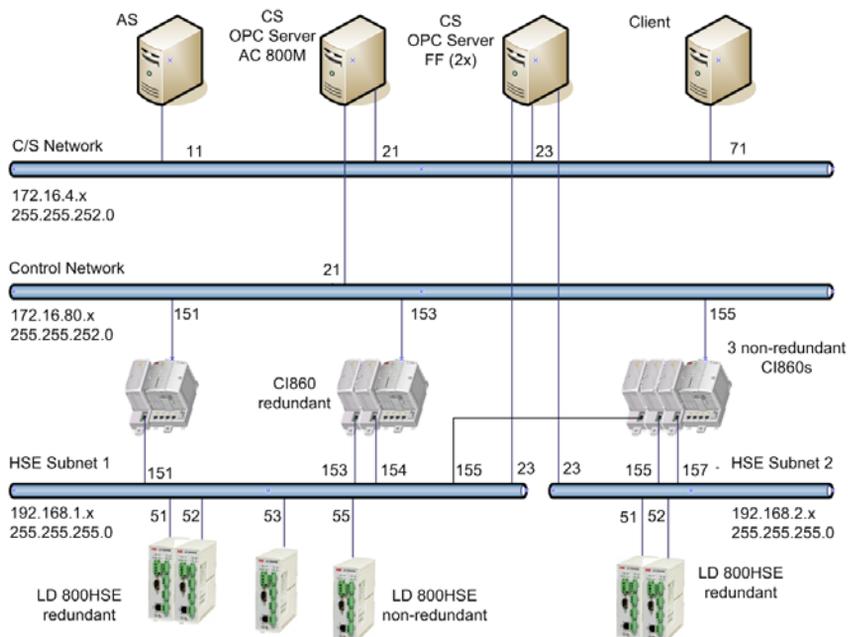


Figure 5. System 800xA network topology

Figure 5 gives an overview of a common 800xA network topology with FOUNDATION Fieldbus. The recommended NetIDs and Subnet Masks for the different Networks are shown in Table 16.

Table 16. Recommendation for NetIDs and Subnet Masks

Network Type	NetIDs	Subnet Mask
Client/Server Networks	172.16.x.0 172.17.x.0 (only for redundancy) where x=4,8,12 to 40 (steps of 4)	255.255.252.0
Control Networks	172.16.x.0 172.17.x.0 (only for redundancy) where x=80, 84, 88 to 124 (steps of 4)	255.255.252.0
HSE Subnets (FOUNDATION Fieldbus)	192.168.x.0 where x=1...40 (‘x’ represents the HSE Subnet, e.g. for HSE Subnet 1 choose 192.168.1.0)	255.255.255.0

For detailed information about the recommended IP addresses and Node numbers for the nodes of a 800xA network as in [Figure 5](#) as well as for informations concerning the network layout refer to *System 800xA Network Configuration (3BSE034463*)*.

Fieldbus Builder FF network configuration and settings

The IP address and subnet mask for the Fieldbus Builder FF are set in the Configure dialog either during the software installation or later on by opening the dialog manually. Refer to *Device Management FOUNDATION Fieldbus, Configuration, (3BDD012902*)*.

OPC Server FF network configuration and settings

Like the Fieldbus Builder FF the IP address and the Subnet Mask are set via the Configure Dialog (during the installation or later on).

The OPC Server FF network configuration is done in Fieldbus Builder FF. Here it is defined which OPC Server(s) FF access which HSE subnet. Refer to *Device Management FOUNDATION Fieldbus, Configuration, (3BDD012902*)*.

AC 800M network configuration and settings

The IP address and subnet mask for the AC 800M are set via the IPConfig tool delivered with Control Builder.

The network configuration for the AC 800M controller is done in Control Builder. For details, refer to the Control Builder documentation.

CI860 network configuration and settings

The IP address and subnet mask for the CI860 is set in Fieldbus Builder FF. In case that the CI860 shall operate in redundant mode (two CI860 working as a redundant pair), two IP addresses have to be configured.

The Control Builder gathers this information and loads the settings during project download into the CI860. Refer to [CI860 IP Configuration](#) on page 42 for details.



The configuration of redundancy for CI860 is done in Control Builder and Fieldbus Builder FF independently. There is a check in Control Builder, if the redundancy configuration from Control Builder and Fieldbus Builder FF does not match a warning message is generated. Nevertheless a download to the controller and the CI860(s) is performed. Ensure to synchronize the redundancy configuration in Control Builder and Fieldbus Builder FF.

Refer to [Section 5, Configuration Changes](#) for details on how changing IP addresses and subnet masks for CI860 takes effect.

Linking Device configuration and settings

The Linking Device IP address and subnet mask can be set via a web interface. For details on configuration and factory setting, refer to the Linking Device documentation.

The network configuration of Linking Device is done in Fieldbus Builder FF. Fieldbus Builder FF is also used to configure Linking Device redundancy. Refer to;

- *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)*
- *Device Management FOUNDATION Fieldbus Linking Device LD 800HSE, User Instructions (3BDD011677*)*.

Configuration in Fieldbus Builder FF

This section describes the IP address configuration for the HSE communication interface module CI860 in Fieldbus Builder FF. For informations concerning the configuration of a FF HSE subnet and its H1 segments with Fieldbus Builder FF, refer to *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)*.

CI860 IP Configuration

One HSE subnet can have multiple HSEHostCI860 objects which are connected to CI860 modules of different AC 800M controller (see [Figure 5](#)). To ensure a proper communication between one HSE Subnet and CI860 module(s), every involved component must have a unique IP address (this includes also redundant CI860 modules). Then, it is described how to configure these unique IP address(es) for the CI860.

CI860 Properties Dialog

Figure 6 shows the CI860 properties dialog. It occurs by inserting a HSEHostCI860 object or it can be opened later manually. To open the CI860 properties dialog manually:

1. Select the **HSEHostCI860** object from tree view
2. **Double-click** with left mouse button on the object
or
context menu > Properties...

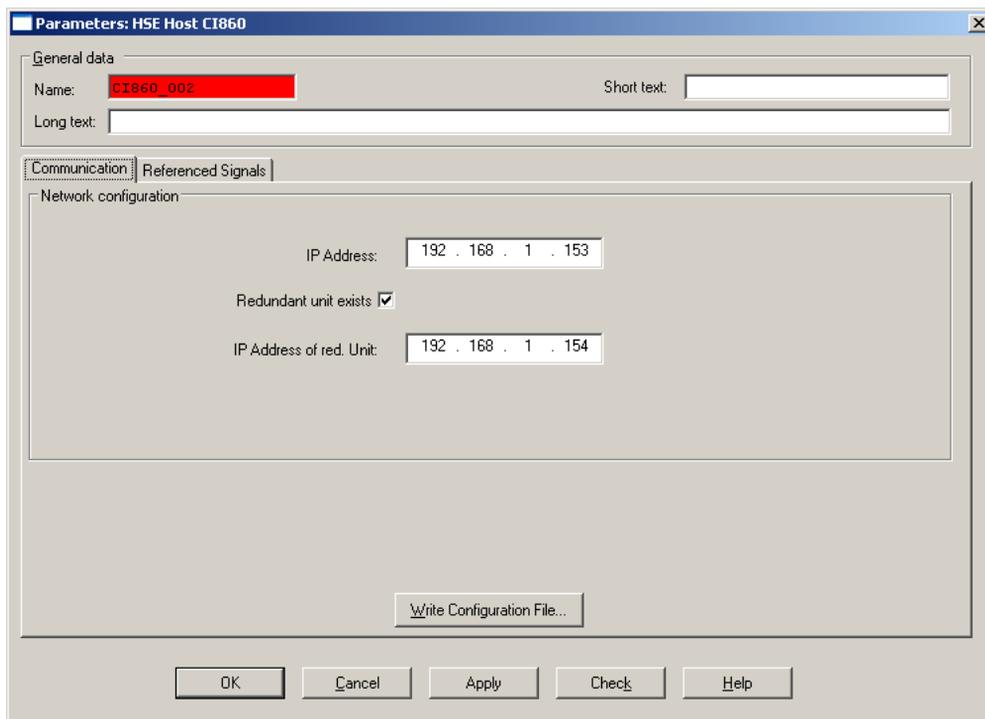


Figure 6. Properties Dialog of HSEHostCI860 object

The CI860 Properties Dialog for the HSE Host object shows the FOUNDATION Fieldbus HSE communication interface CI860 of the IEC 61131 controller. Data

such as the tag name the IP address(es) are displayed and can be configured here. Concerning the IP address configuration see [Table 17](#).

Table 17. Dialog Elements of HSEHostCI860 Properties Dialog

Dialog element	Description
IP Address	<p>The IP address is used for identifying the HSE host and forms the basis for all connection-oriented communication with the HSE host. The address entered here is loaded to the CI860 module via Control Builder.</p> <p> Both the IP address of the HSE host and the IP address of the redundancy module must be valid, unique IP addresses from the HSE subnet.</p>
IP Address of red. Unit	The IP address of the redundancy module is entered here.
Redundant unit exists	<p>This parameter is used to configure the HSE host as a redundancy pair.</p> <p><input type="checkbox"/> No redundancy. <input checked="" type="checkbox"/> Redundancy.</p>

Network Configuration Dialog

The Network Configuration dialog of FBB FF shows the network settings of all configured FF Objects of the Client/Server and the HSE Network. [Figure 7](#) shows this dialog with the network configuration for the HSE Subnet 1 from [Figure 5](#). Next to the centralized overview of the network settings this dialog allows changes at the configuration.

If the IP address of one CI860 module should be modified it is possible to do this via the Properties Dialog of the FF Object as described above or directly out of the Network Configuration Dialog. Changes done in the Network Configuration Dialog will be assumed by the FF objects (e.g. the HSEHostCI860 object).

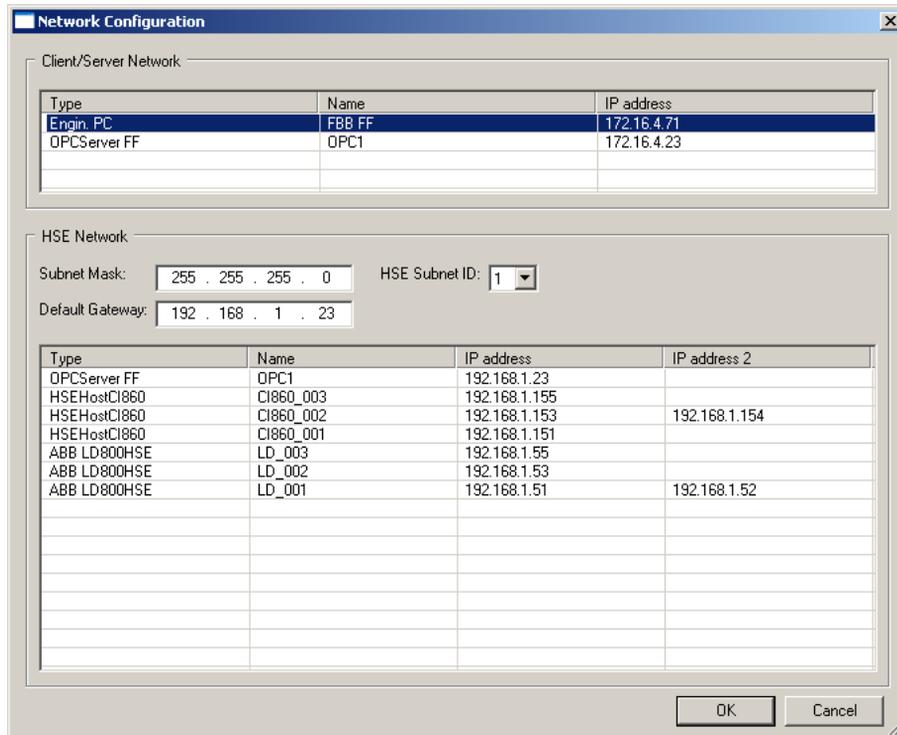


Figure 7. Network Configuration Dialog of Fieldbus Builder FF

Configuration in Control Builder

The communication between the FOUNDATION Fieldbus HSE network and the AC 800M controller is handled by the CI860 FF HSE communication interface module. This section describes how to configure this CI860 module in Control Builder. It is assumed that a project with Control Builder Professional was created and that a controller was added to the project.

Hardware Library

Hardware libraries are used to configure hardware types. For detailed informations about the handling of hardware libraries, refer to *System 800xA Control AC 800M Configuration (3BSE035980*)* manual.

Insert CI860

To insert a new CI860 proceed as described.

1. Right-click on the controller you want to insert the CI860 and select **Insert Unit**. The Insert Unit dialog pops up.

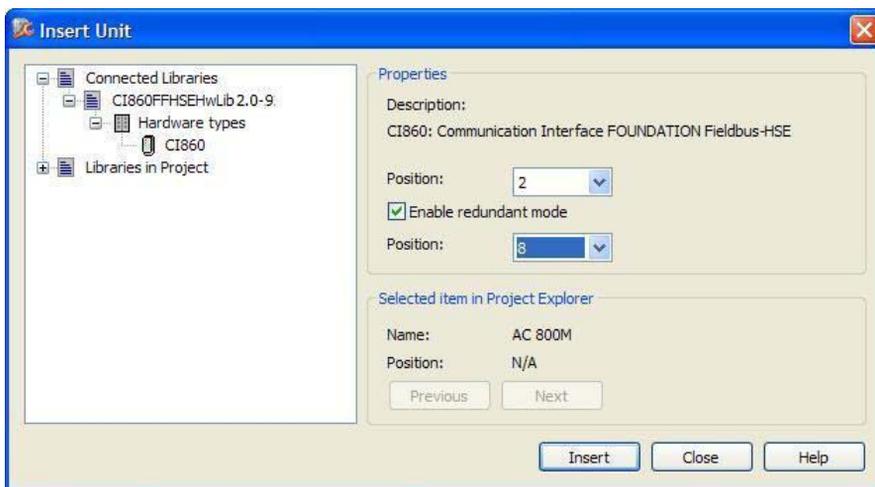


Figure 8. Dialog for inserting CI860

2. Expand the library for CI860 under Connected Libraries and select the CI860 hardware type.
3. Select a position for the hardware unit in the dialog box displayed. The first available position is chosen by default. If another position is desired, click the list box to display available positions and select the desired one.

4. If the module shall be set redundant check **Enable redundant mode**. This releases the dialog box for the position of the backup unit. Select a position for the backup unit.
5. Click **Insert** button to apply the current changes.
6. Click **Close** to close the dialog or proceed inserting further units.
7. The hardware unit is now included in the tree. The icon shown in the tree depends on if redundancy is configured or not. For a redundant configured unit the position for the backup module is presented within parenthesis.

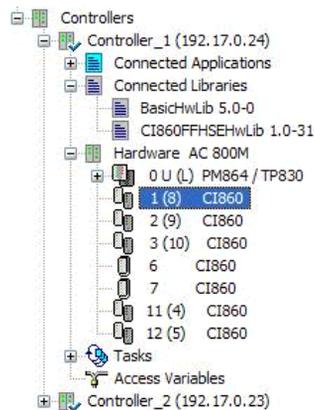


Figure 9. Redundant CI860 in Hardware Tree

Add Redundancy for CI860

If the CI860 is already configured and running in single mode you can add redundancy.

1. Right-click on the unit you want to add the redundancy and select **Redundancy > Add Redundant Unit**.

2. Select a position for the backup unit in the dialog box displayed. The first available position is chosen by default. If another position is desired, click the list box to display available positions and select the desired one.

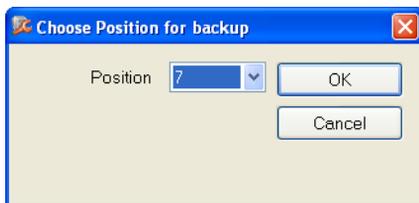


Figure 10. CEX-Bus Position for backup CI860

3. The icon changes to the redundancy icon and the text is updated with backup position within parenthesis (see [Figure 7](#) on page 47).



The inserted backup unit is called unit B. Unit B is fixed related to the configured position. Unit B starts as backup but acts as primary after failover.

Delete Redundancy for CI860

If the CI860 is already configured and running in redundant mode you can delete redundancy.

1. Right-click on the CI860 you want to delete redundancy for and select **Redundancy > Delete Backup**.
2. The icon changes to the single icon and the position for the backup is deleted in the text.



In the offline mode of Control Builder unit B is always presented as the backup unit independent of the current state. Therefore always unit B will be deleted as backup. If you download and go online a failover may be performed by CI860 if unit B acts as primary. Unit A gets primary and afterwards unit B will get deleted.

Configure CI860

Open the HW editor via double-click on the hardware unit or choose Editor from the CI860 context menu. The HW editor contains the following tabs: Connections, Status and Unit Status.

Connections Tab

The Protocol Info column on the Connections tab displays the CI860 HSE configuration requested from Fieldbus Builder FF. It displays the names of the FF signals being mapped to CI860 channels. For further information on the Connections tab, refer to [FF Signal Mapping](#) on page 62.

Status and Unit Status Tabs

For information on the Status and Unit Status tabs, refer to Control Builder online help and to [Online Data](#) on page 92.



Presence of CI860 with same IP Address as that of configured CI860 may fail to establish Client/Server Communication. Ensure that unused CI860 is having valid and Unique IP before plugging it for use.

Plant Explorer Integration

The configuration of the FOUNDATION Fieldbus HSE Communication Interface Module CI860 is done in the two aspect systems Fieldbus Builder FF and Control Builder. These two parts are connected so that configuration informations can be transferred from the Fieldbus Builder FF to Control Builder. This connection between Fieldbus Builder FF and Control Builder is configured from the Plant Explorer Workplace and will be described in this section.

A Control Structure with a Control Network and a single HSE subnet is shown in [Figure 11](#). In case that multiple HSE subnets are configured, each HSE subnet is represented by a separate subnet structure in the Control Structure.

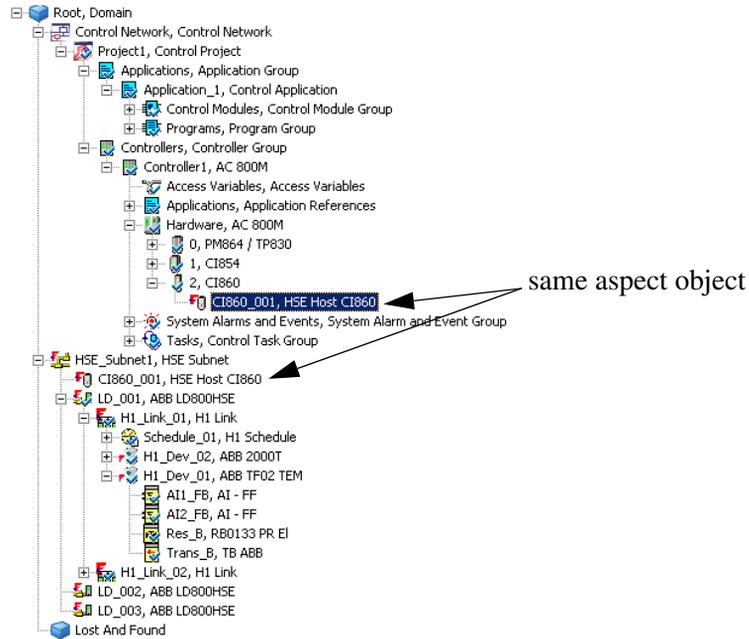


Figure 11. Control Structure with Control Network and HSE subnet

The HSE Host CI860 object represents the HSE device in the CI860 module. It can be found twice: in the HSE Subnet and in the Control Network below the CI860 Interface Module. This object is used to connect the two configurations from Fieldbus Builder FF and Control Builder.

Connect CI860 to the HSE Subnet

To establish the connection to the CI860 it is necessary to insert a reference of the HSE Host CI860 object below the CI860 module in the Plant Explorer Control Structure. This object will not be visible in Control Builder. To create a reference do the following:

1. Navigate to the HSE Host CI860 object in the HSE Subnet of the Control Structure.
2. Select the HSE Host CI860 object.
3. Insert the object by moving it to the CI860 object in the control project. During the action hold the CTRL+SHIFT keys.
4. Drop the HSE Host CI860 object onto the CI860 object (see [Figure 12](#)).

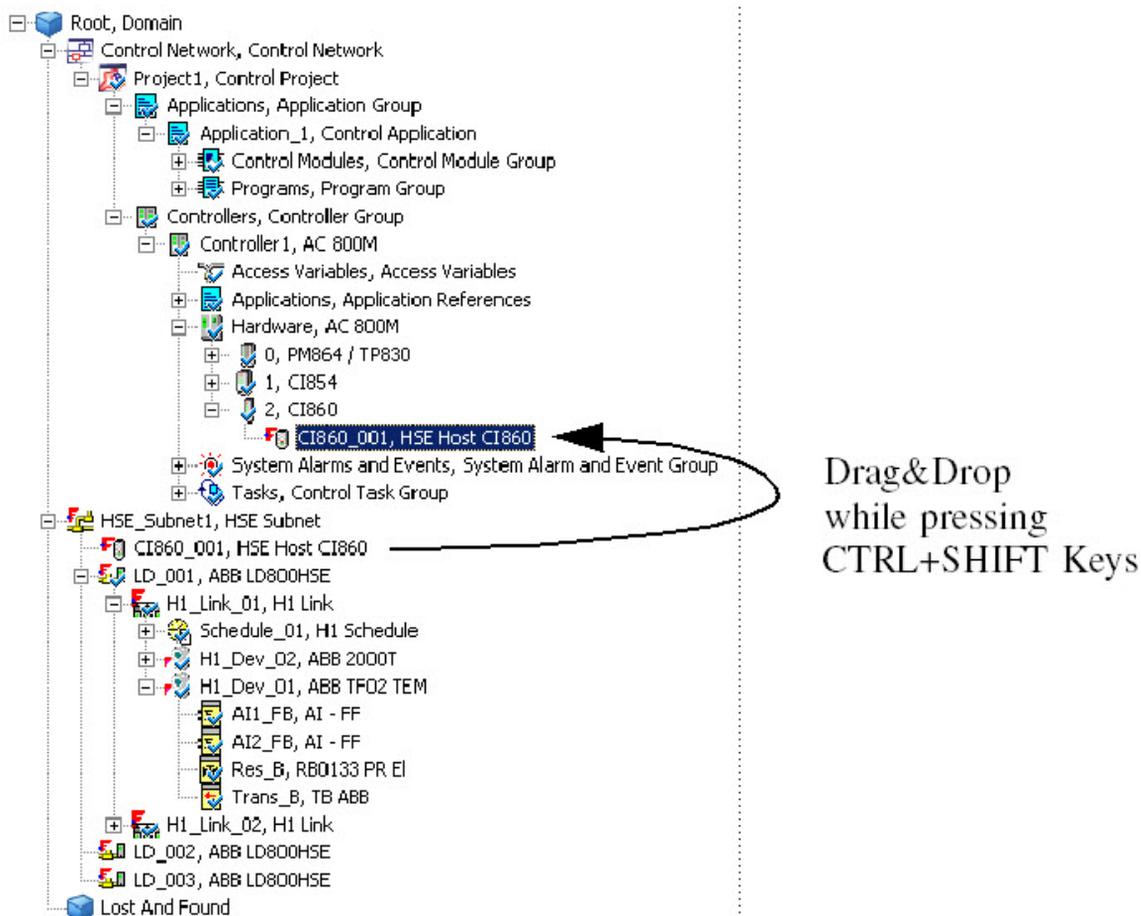


Only one HSE Host CI860 object can be placed below each CI860 object.

5. Repeat steps 1 to 4 for all HSE Host CI860 objects.



It is important to place a reference of the HSE Host CI860 object and no copy below the CI860 in order to establish the connection. To check that a reference is created verify that the HSE Host CI860 object has two Control Structure aspects. This indicates that the same object is visible twice in the Control Structure.



Drag&Drop
while pressing
CTRL+SHIFT Keys

Figure 12. Create Reference of the HSE Host CI860 Object

Alternatively do the following:

1. Select the CI860 object in the Control Network.
2. Select **Insert object** from the context menu.

3. Select the HSE Host CI860 object from HSE Subnet in the Control Structure (see [Figure 13](#)).

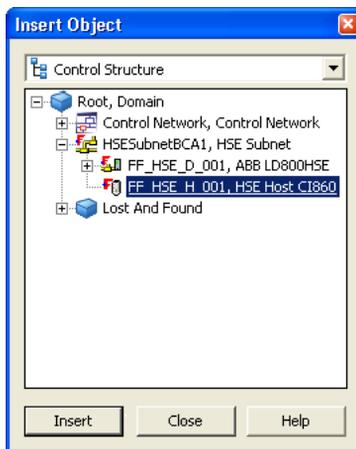


Figure 13. Insert HSE Host CI860 Object

4. Click **Insert**. The HSE Host CI860 object is inserted below the CI860 object.



Refer [Connect CI860 to the HSE Subnet](#) on page 51.

5. Repeat steps 1 to 5 for all CI860 objects.

Click **Close** to close the window.

Now a reference of the HSE Host CI860 object has been inserted below the CI860 object (see [Figure 11](#)). Selecting the HSE Host CI860 object shows that it now has two Control Structure aspects as it is placed twice in the Control Structure.

Change CI860 connectivity to HSE Subnet

Changing the connection between a CI860 module and an HSE subnet requires special attention as the IP address of the CI860 module is part of the HSE subnet configuration and therefore set in Fieldbus Builder FF.

To change the reference between HSE Host CI860 and CI860 module to another module at the same or different AC 800M controller simply move the HSE Host CI860 object to the other CI860 module in the Plant Explorer Workplace Control Structure. Thereby the CI860 module to which the HSE Host CI860 object is connected gets the appropriate CI860 configuration. This CI860 module gets the same IP address assigned as the previous CI860 module.

This will cause an address conflict on the HSE subnet after the controller(s) have been loaded, reset, so that the IP address change on the CI860 becomes effective and loaded again. A CI860 module that has no connection to an HSE subnet will be loaded from Control Builder with a null configuration. The CI860 module will keep the previous IP address that is now also use by the second CI860 module.



To avoid IP address conflicts on the HSE subnets ensure that each CI860 module in the Plant Explorer Workplace Control Structure is connected to an HSE subnet containing a unique IP address for this CI860 module.

Application Programming

Control application can be distributed in AC 800M controller and Foundation Fieldbus devices. The FF applications running in the Foundation Fieldbus devices are configured with Fieldbus Builder FF, the IEC 61131 applications running in the AC 800M controller with the Control Builder. In the IEC 61131 applications running in the AC 800M controller, FF Signals which are communicated by the communication types Publisher/Subscriber and Client/Server can be accessed. The exchange is handled by the FOUNDATION Fieldbus HSE Communication Interface Module CI860

This section describes the necessary configurations in both aspects system (Fieldbus Builder FF and Control Builder) to access FF signals for applications programming in Control Builder. For the applications programming of the different communication types, refer to [Application Programming for Publisher/Subscriber Communication](#) on page 61 and [Application Programming for Client/Server Communication](#) on page 77.

Configuration within Fieldbus Builder FF

Assign Signals to CI860

FF signals which should be accessed in an AC 800M controller have to be assigned to a HSE Host CI860 object which is referenced to a specific CI860 module of the associated controller. For further informations concerning the connection between HSE Host CI860 object and the CI860 module, refer to [Connect CI860 to the HSE Subnet](#) on page 50. How to assign the FF signals to a HSE Host CI860 object is described below.

Signal Properties Dialog

Figure 14 shows the Fieldbus Builder FF Signal Properties Dialog of a FOUNDATION Fieldbus signal. This dialog gives informations about all characteristics of the FF signal and allows the configuration of them.

In the bottom of the dialog the usage of the signal is displayed. This includes the connections to Foundation Fieldbus function blocks and the assignment to CI860 Hosts. By enabling the check mark next to a CI860 Host the signal is assigned to one channel of the host. The channel type and the channel number depends on the data type and the free channels of the CI860 Host. They are given automatically. If the Host is the source of a signal the cycle time can be defined by the user, default value is 1000ms. Else the cycle time will be defined by the schedule configured in Fieldbus Builder FF.

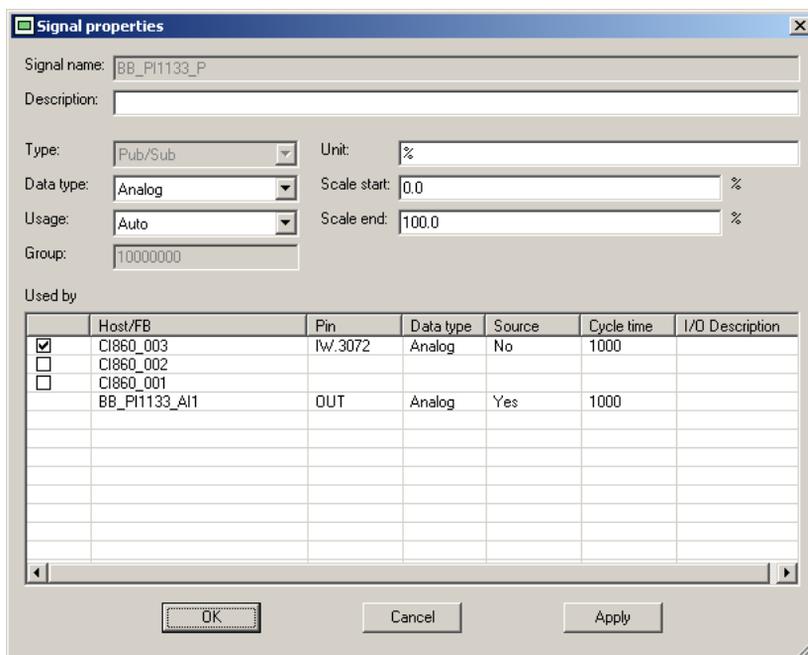


Figure 14. Signal Properties Dialog of a FOUNDATION Fieldbus signal

To open the Signal Properties Dialog:

1. Open the context menu by a right click on a signal in the Signal List or by a right click on a signal in the FF Application Editor.
2. Select **Properties...**

For further informations about the Signal Properties Dialog and Signal List (see next chapter), refer to *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)* manual.

FF Signal List.

The Fieldbus Builder FF signal list contains all the signals used in the HSE Subnet ([Figure 15](#)). The bottom section of this dialog is the same as from the Signal Properties Dialog. It gives informations which CI860 hosts and function blocks are using the selected signal. Also the configuration of the usage can be configured here like in the Signal Properties Dialog (see [Signal Properties Dialog](#) on page 56), even with multiple selected signals.

To call up the Signal List, select **Tools > Signal list**

Alternatively the signal list can be called up by a menu button.

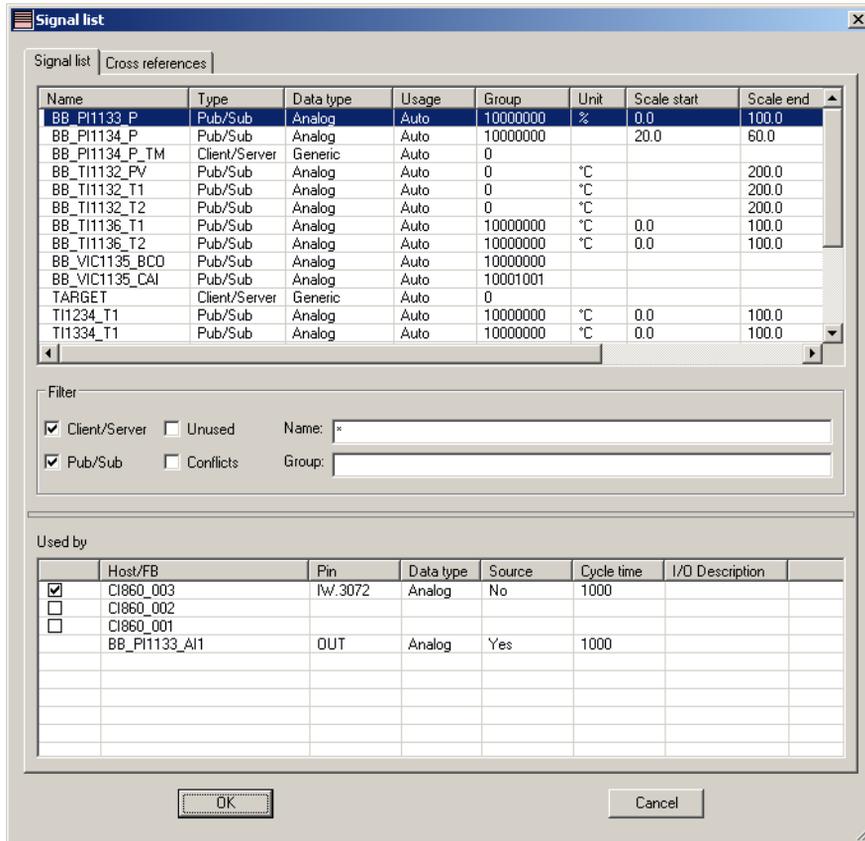


Figure 15. Structure of the Signal List

Check and Save Configuration

Control Builder gets the CI860 configuration for example the CI860 HSE configuration and the IP address(es) from Fieldbus Builder FF. The Control Builder fetches the CI860 HSE configuration from the last plausible/checked and saved Fieldbus Builder FF configuration. The CI860 Protocol Info column (see Figure 18)

is updated once the CI860 hardware editor is opened in Control Builder. An already opened hardware editor has to be re-opened for data refreshing. For further informations refer to [FF Signal Mapping](#) on page 62

Configuration within Control Builder

This sections describes how to add the FF HSE Communication Library which provides control modules and function blocks for a convenient handling of the FOUNDATION Fieldbus data in Control Builder.

The communication types Publisher/Subscriber and Client/Server demand different handling to access FOUNDATION Fieldbus data. For the application programming of these communication types with the mentioned control modules and function blocks, refer to [Application Programming for Publisher/Subscriber Communication](#) on page 61 and [Application Programming for Client/Server Communication](#) on page 77.

FF HSE Communication Library

This library needs to be added to your Control Builder project. Once the library has been added to your project you can connect it to those applications in which you want to use the control modules and function blocks contained in the library. To add the FFHSECommLib to your project do the following:

1. Select your control project in the Plant Explorer workplace.
2. Select the Project aspect.
3. Switch to the Libraries tab.
4. Click **Insert** to add a library.

5. Select the FFHSECommLib (see [Figure 16](#)).

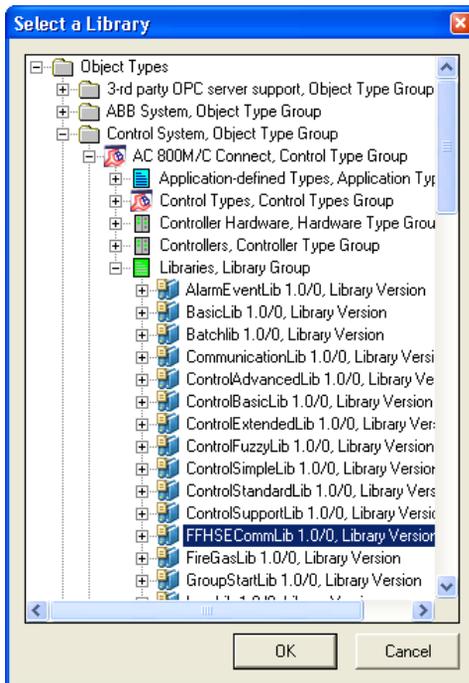


Figure 16. Select Library

6. Click **OK**.
7. The FFHSECommLib now appears in the list of libraries available in your project (see [Figure 17](#)).

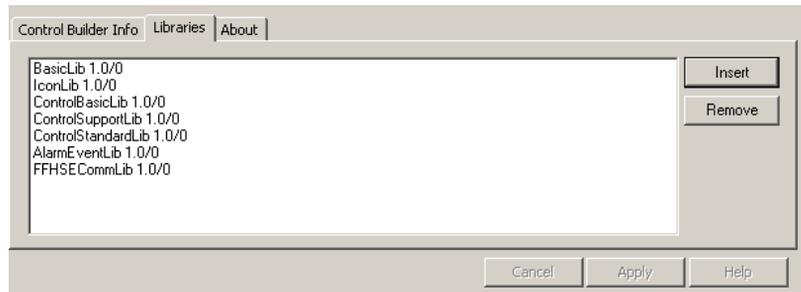


Figure 17. List of Libraries added to the Control Builder Project

Now that the library has been added to your project the library must be connected to your applications.

1. Select your application in Control Builder.
2. Click Connected Libraries in the tree and choose **Connect library** from the context menu.
3. The pull down list displays those libraries that were added to the project but up to know not connected to this application. Select the FFHSECommLib.
4. Click **OK**.

The control modules and function blocks in the FFHSECommLib are now available.

Application Programming for Publisher/Subscriber Communication

This section describes the configuration to access and handle FOUNDATION Fieldbus signals which are communicated by Publisher/Subscriber communication in Control Builder applications.

For information on application programming that is not specific to FOUNDATION Fieldbus, refer to the Control Builder documentation.

FF Signal Mapping

FOUNDATION Fieldbus Publisher/Subscriber signals previously specified within Fieldbus Builder FF to be connected to a dedicated CI860 have to be assigned to AC 800M controller application variables. To make connections between variables and I/O channels or other hardware channels (for example statistic channels) open, as usually done for any other AC 800M I/O module, the Hardware Configuration Editor of the CI860 module and select the Connections tab (see [Figure 18](#)). All I/O access is carried out through a variable connected to an I/O channel.



Because of the large number of channels in the CI860, it is possible to hide unconnected channels. If **Hide Unused Channels** is selected from the **View** menu, channels not connected on the IEC61131 side or on the FOUNDATION Fieldbus side are hidden on the Connections Tab.



If the CI860 HSE Host object is not plausible/checked in Fieldbus Builder FF or no HSE Host CI860 object is connected to the CI860 the hardware editor will show <NOT FOUND> in Protocol Info column. The specific reason is available in the message pane of Control Builder and in the session.log at download. Performing download in this case might delete a running configuration in CI860.

Channel	Name	Type	Variable	Protocol Info	I/O Description
IW1.3076	FF Real Subscribe 4	ReallIO	Application_1.D5AI1Out	D5AI1Out	
IW1.3077	FF Real Subscribe 5	ReallIO	Application_1.D7AI1Out	D7AI1Out	
IW1.3079	FF Real Subscribe 7	ReallIO	Application_1.D14A0BK0	D14A0BK0	
IW1.3080	FF Real Subscribe 8	ReallIO	Application_1.D10BK0	D10BK0	
IW1.3081	FF Real Subscribe 9	ReallIO	Application_1.D14A0OUT	D14A0OUT	
IW1.3082	FF Real Subscribe 10	ReallIO	Application_1.D8AI1Out	D8AI1Out	
IW1.3083	FF Real Subscribe 11	ReallIO	Application_1.D6AI1Out	D6AI1Out	
IX1.4096	FF Discrete Subscribe 0	BoollIO	Application_1.D9AI0UTD_B	D9AI0UTD	
IW1.4097	FF Discrete Subscribe 0	DwordIO	Application_1.D9AI0UTD_D	D9AI0UTD	
IW1.6500	No of HSE publisher	DintIO	Application_1.CI1_HSEPub	Extended status	
IW1.6501	No of HSE subscriber	DintIO	Application_1.CI1_HSESub	Extended status	
IW1.6502	CPU load	DintIO	Application_1.CI1_CPULoad	Extended status	
IW1.6503	No of send failed	DintIO	Application_1.CI1_SendFail	Extended status	
IW1.6504	No of exp. stall count	DintIO	Application_1.CI1_ExpStall	Extended status	
IW1.6505	Average FF load	DintIO	Application_1.CI1_AvFFLoad	Extended status	
IW1.6506	UDP received w/o processing	DintIO	Application_1.CI1_UDPwoProc	Extended status	
IW1.6507	Reserved 2	DintIO	Application_1.CI1_Res2	Extended status	
IW1.6508	Reserved 3	DintIO	Application_1.CI1_Res3	Extended status	
IW1.6509	No Ctl/Srv requests	DintIO	Application_1.CI1_CSReq	Extended status	
IW1.6510	No Ctl/Srv reads	DintIO	Application_1.CI1_CSRead	Extended status	
IW1.6511	No Ctl/Srv writes	DintIO	Application_1.CI1_CSWrite	Extended status	
IW1.6512	No Ctl/Srv reads failed	DintIO	Application_1.CI1_CSReadFail	Extended status	
IW1.6513	No Ctl/Srv writes failed	DintIO	Application_1.CI1_CSWriteFail	Extended status	
IW1.6514	No Ctl/Srv connects	DintIO	Application_1.CI1_CSConnects	Extended status	
IW1.6515	No Ctl/Srv connects failed	DintIO	Application_1.CI1_CSConnFail	Extended status	
IW1.6516	No Ctl/Srv connection aborts	DintIO	Application_1.CI1_CSAborts	Extended status	
IW1.6517	Reserved	DintIO	Application_1.CI1_Res1	Extended status	
IW1.6518	UnitStatus	HwStatus	Application_1.CI1_UnitStatus		

Figure 18. CI860 Connections Tab (*Hide Unused Channels* applied)

Connections can only be edited in Offline mode. The CI860 channels are listed with Channel, Name, Type, Variable, Protocol Info and I/O Description (see [Table 18](#)).

Table 18. Connections Editor, Columns Description

Column	Description
Channel	<p>The address of each channel is given as the complete search path, which consists of the hardware address and the I/O address following one of these prefixes:</p> <p>IX = in Booleans QX = out Booleans IW = in non-Booleans QW = out non-Booleans</p> <p>Examples:</p> <p>QW1.7, where QW represents a non-Boolean output, 1 represents the hardware address and 7 represents the I/O channel.</p> <p>QX1.1024, where QX represents a Boolean output of type BoolIO, 1 represents the hardware address and .1024 represents the I/O channel.</p> <p>QW1.1025, where QW represents a Boolean output of type DwordIO, 1 represents the hardware address and .1025 represents the I/O channel.</p> <p>QX1.1024 and QW1.1025 are referenced as QX.1024/1025 in the Fieldbus Builder FF because it represents only one signal, which can be connected to two different data types in Control Builder.</p> <p>For all channels the hardware address is ignored in Fieldbus Builder FF.</p> <p>For limitations regarding the overall use of channels, refer to Dimensioning Guidelines on page 33</p>
Name	The name of the channel.
Type	Data type of the channel. This type corresponds to the system data type of the variable to which the channel is connected.

Table 18. Connections Editor, Columns Description (Continued)

Column	Description
Variable	<p>Variable to connect to the channel. To enter a variable correctly, use the following syntax:</p> <p>POU name.variable</p> <p>You can omit the POU name if the variable is global and located in the outermost level, otherwise enter the complete POU path.</p> <p>You can also connect the variables to the I/O channels by selecting a variable cell and clicking Ctrl+J. Another option is to click the Insert path button in the toolbar. This gives you access to the application program in the Project Explorer tree, where you can find the desired declared variable using the arrow keys or the cursor. Double-click the variable and it will be connected.</p>
Protocol Info	<p>Signal source information out of FF. The Protocol Info column shows the FF signal name mapped to the CI860 I/O channel inside the Fieldbus Builder FF configuration part.</p>
I/O Description	<p>Text that describes the current channel. A white background indicates that you can change the values in the Variable and the I/O Description columns.</p>



The channels address of a I/O channel contains the CEX Bus slot number. In Fieldbus Builder FF this number is not visible. For example the channel address QW1.7, where QW represents a non-Boolean output, 1 represents the hardware address and .7 represents the I/O channel. In Fieldbus Builder FF this channel is referenced as QW.7

A grey background indicates that you cannot change the values in the Channel, Name, Type and the Protocol Info columns.

If something is changed, and the next or previous unit is opened, or if the window is closed, a dialog box is displayed asking whether or not the changes are to be applied. You can also apply changes using the **Save** button in the toolbar, or **Save** in the **Editor** menu.

I/O Channels

The I/O channels are used to map variables to CI860 channels. Analog channels are mapped to the RealIO data type whereas discrete channels can be mapped to either the BoolIO or the DwordIO data type. For detailed information refer [Data Types](#) on page 22. The number of CI860 channels to which variables can be mapped depends to the data type. Refer to [Dimensioning Guidelines](#) on page 33.

Statistic Channels

Next to the I/O channels, there are a number of statistic channels that supply specific diagnostic data on Publisher/Subscriber communication in online mode. Refer to [CI860 Statistic Channel](#) on page 88.

FF Signal Status Handling

For proper handling of FF signals it is necessary to handle the FF status information in Control Builder applications. This especially applies to an instance which IEC 61131 variables are to be written to FF signals. Dedicated FF control modules and function blocks offer convenient handling of this status information (see [FF Specific Control Modules and Function Blocks](#) on page 67).

For detailed information to the FF Status refer to [FF Status Handling](#) on page 22 and [Overview FF Signal Status](#) on page 25.

FF Specific Control Modules and Function Blocks

This section describes the FOUNDATION Fieldbus specific control modules and function blocks for analog and discrete FF signals.

For analog FF signals two FOUNDATION Fieldbus specific control modules are available. They are used in applications where FOUNDATION Fieldbus signals works in control loops with standard control modules, e.g. PID, and act as a connection point between the FOUNDATION Fieldbus world and the IEC 61131 world. They provide conversion between FOUNDATION Fieldbus data types and ControlConnection data type, used in the control modules.

For discrete FF signals four FOUNDATION Fieldbus specific function blocks are available. They handle the conversion between FOUNDATION Fieldbus signals and IEC 61131 signals.

Analog Signal Handling.

For the usage of analog FF Process signals in Control Builder applications the IO channels of the CI860 module has to be mapped to variables defined in Control Builder. This can be done with variables from the data type RealIO or the Control Connection type FFRealConnection which can handle two RealIO signals (forward and backward signal).

Control Connections are used for control loops in which forward and backward signals are handled. They act as a connection between control modules. [Figure 19](#) shows the data type structure of a Control Connection from the data type FFRealConnection. The forward and the optional backward signal are mapped to separate I/O Channels of the CI860. For simple loops in which no backward signal is needed it is also possible to use directly a variable from the data type RealIO. The structure of this data type is similar to the forward signal of the Control Connection data type (see [Figure 19](#)).

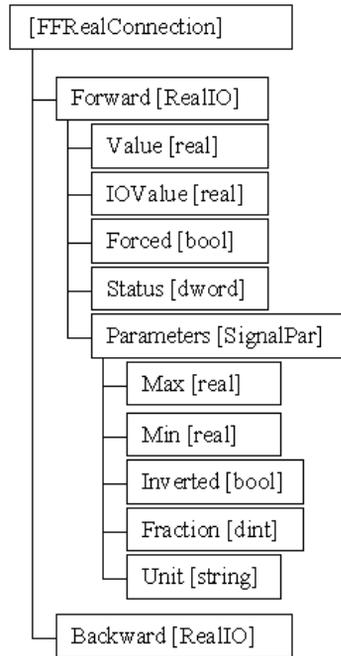


Figure 19. FFRealConnection Data Type Structure

For a convenient handling of analog FF Signals in control loops two FOUNDATION Fieldbus specific control modules exist. These control modules are AnalogInFFToCC and AnalogOutCCToFF.

Table 19. Library Objects for FOUNDATION Fieldbus HSE P/S Communication, Analog Handling

Object Name	Object Type	Description
AnalogInFFToCC	Control module type	Used for collecting data from an analog Foundation Fieldbus function block. Cascade Mode is supported, e.g. the In.Forward is connected to the OUT of the FOUNDATION Fieldbus function block and In.Backward is connected to BKCAL_IN of the FOUNDATION Fieldbus function block.
AnalogOutCCToFF	Control module type	Used for deliver data to an analog FOUNDATION Fieldbus function block. Cascade Mode is supported, e.g. the Out.Forward is connected to the CAS_IN of the FOUNDATION Fieldbus function block and Out.Backward is connected to BKCAL_OUT of the FOUNDATION Fieldbus function block.

AnalogInFFToCC

The AnalogInFFToCC control module reads the FF Signal (via a CI860 I/O channel) and converts it to a ControlConnection data type, which can be used e.g. as PV input to a PID Control Module (see example shown in [Figure 21](#))

The FOUNDATION Fieldbus signal is connected to the In parameter of the AnalogInFFToCC control module. This In parameter has the data type FFRealConnection which is divided into a forward and a backward part as shown in

Figure 19. To connect the FF Signal to the AnalogInFFToCC control module do the following steps:

1. Declare a variable of FFRealConnection type and connect it to the In input parameter of the AnalogInFFToCC control module (see Figure 20).
2. Connect the Forward component of the declared variable to an input I/O channel of RealIO type in the Hardware Configuration Editor of the CI860 (see Figure 18).
3. Connect the optional Backward component of the declared variable to an output I/O channel of RealIO type in the Hardware Configuration Editor of the CI860 (see Figure 18).

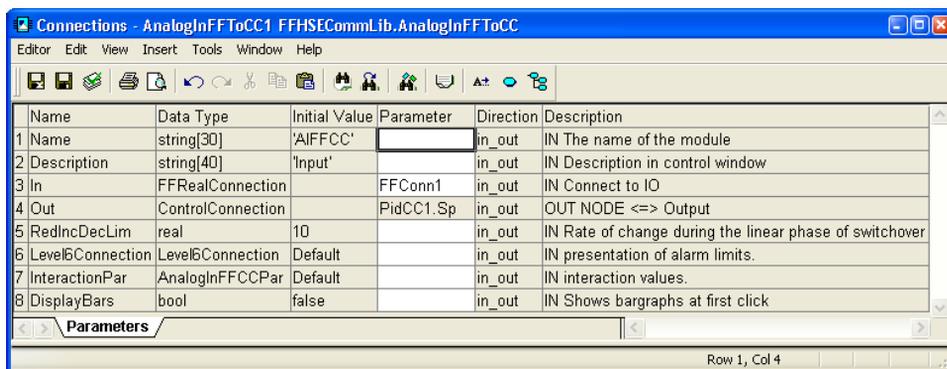


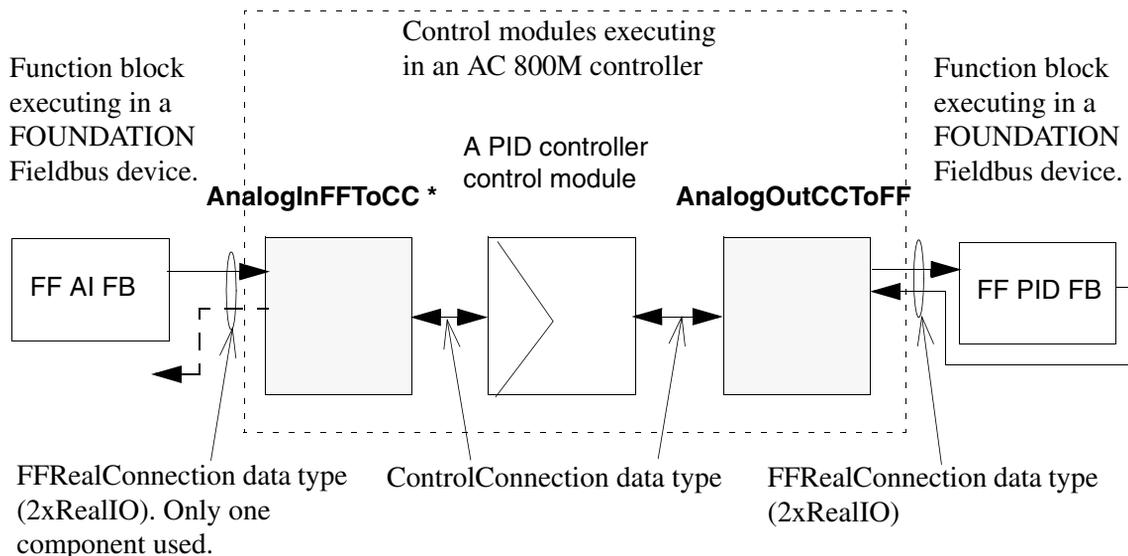
Figure 20. AnalogInFFToCC Connections Editor

The In parameter is converted to an OUT parameter of the ControlConnection data type. The Value and Status components of the FF signal are copied to the Forward.Value and Forward.Status component of the Out parameter. FF status information is mapped in such a way that it fits the OPC status used in the ControlConnection signal. Scaling information for the Range will be updated from the Min, Max, and Unit components of the IN parameter.

AnalogOutCCToFF

The AnalogOutCCToFF control module writes the Value and Status components of the IN parameter, which is in the example below a copy of the OUT parameter of a PID master in the controller. The data is transferred to a PID slave function block in

a FOUNDATION Fieldbus device (working as a cascade loop, PID.Cas_IN parameter of the PID function block). The PID slave function block uses the transferred value as an external set point value.



* can be omitted by using the CI860 channel directly (RealIO) since no backward signal is used

Figure 21. Example of Typical Usage of FOUNDATION Fieldbus Analog Control Modules

The OUT parameter of the AnalogOutCCToFF control module is of the type FFRealConnection (see [Figure 19](#)). To perform a connection to an output I/O channel of the CI860 do the following steps:

1. Declare a variable of the FFRealConnection type and connect it to the Out parameter of the AnalogOutCCToFF control module (see [Figure 22](#)).

2. Connect the Forward component of the declared variable to an output I/O channel of RealIO type in the Hardware Configuration Editor of the CI860 (see [Figure 18](#)).
3. Connect the optional Backward component of the declared variable to an input I/O channel of RealIO type in the Hardware Configuration Editor of the CI860 (see [Figure 18](#)).

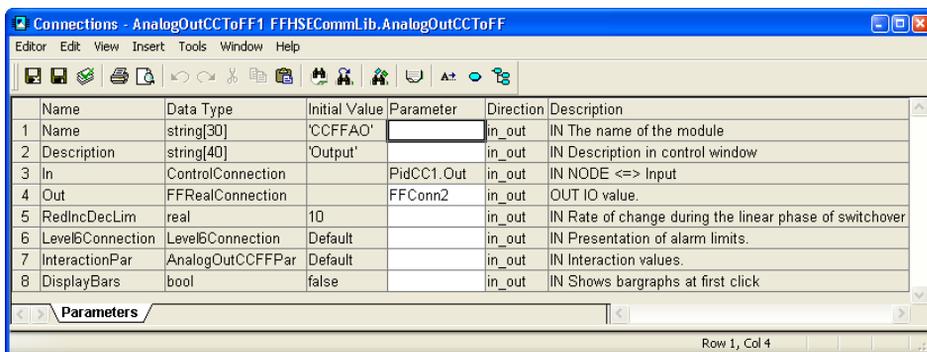


Figure 22. AnalogOutCCToFF Connections Editor

The Value and Status components of the FF signal are copied to the Forward.Value and Forward.Status component of the Out parameter. Status information will be copied to the OUT parameter. Scaling information for the Range will be updated from the Min, Max, and Unit components of the OUT parameter.

Discrete Signal Handling.

There are four FOUNDATION Fieldbus specific function blocks for discrete signals which handle conversion between FF signals and IEC 61131 signals. The function blocks are used with a user written application.

Table 20. Library Objects for FOUNDATION Fieldbus HSE P/S Communication, Digital Handling

Name	Object type	Description
FFToBoolIOIn	Function block type	Used for collecting data from a discrete FOUNDATION Fieldbus function block. The FOUNDATION Fieldbus boolean structure (DS66) is mapped to a bool, false(0) or true(1).
BoolIOToFFOut	Function block type	Used to deliver data to a discrete FOUNDATION Fieldbus function block. The FOUNDATION Fieldbus boolean structure (DS66) is mapped to a bool, false(0) or true(1). Cascade Mode is supported, e.g. the Out.Forward is connected to the CAS_IN_D of the FOUNDATION Fieldbus function block and Out.Backward is connected to BKCAL_OUT_D of the FOUNDATION Fieldbus function block.
FFToDwordIOIn	Function block type	Used for collecting data from a discrete FOUNDATION Fieldbus function block. The complete FOUNDATION Fieldbus boolean structure (DS66) is supported, all 256 states - not only false (0) or true (1). The boolean structure is mapped to the LSB of the value.
DwordIOToFFOut	Function block type	Used for deliver data to a discrete FOUNDATION Fieldbus function block. The complete FOUNDATION Fieldbus boolean structure (DS66) is supported, all 256 states - not only false (0) or true (1). The boolean structure is mapped to the LSB of the value. Cascade Mode is supported, e.g. the Out.Forward is connected to the DCAS_IN of the FOUNDATION Fieldbus function block and Out.Backward is connected to DBKCAL_OUT of the FOUNDATION Fieldbus function block.

FFToBoolIOIn

The FFToBoolIOIn function block reads the OUT parameter of a discrete FOUNDATION Fieldbus input function block. The IN parameter of the FFToBoolIOIn function block is of type FFBoolConnection. Figure 23 shows the

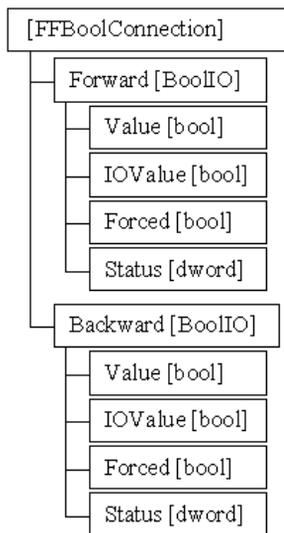


Figure 23. FFBoolConnection Data Type Structure

structure of the FFBoolConnection data type. The forward component of the FFBoolConnection data type has to be mapped to a CI860 channel of BoolIO type. The Value and Status components of the FF signal are copied to the Value and Status components of the Out parameter of type BoolIO.

BoolIOTtoFFOut

The BoolIOTtoFFOut function block writes to the IN parameter of a discrete FOUNDATION Fieldbus output function block. The OUT parameter of the BoolIOTtoFFOut function block is of type FFBoolConnection. Figure 23 shows the structure of the FFBoolConnection data type. The forward and backward components of the FFBoolConnection data type have to be mapped to a CI860

channel of BoolIO type. The Value and Status components of the FF signal are copied from the Value and Status component of the IN parameter of type BoolIO.

FFToDwordIOIn

The FFToDwordIOIn function block reads the OUT parameter of a discrete FOUNDATION Fieldbus input function block. The IN parameter of the FFToDwordIOIn function block is of type FFDWordConnection. [Figure 24](#) shows

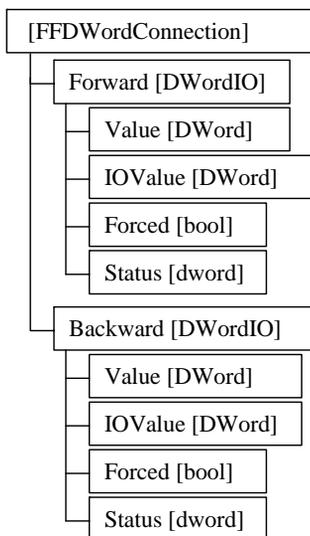


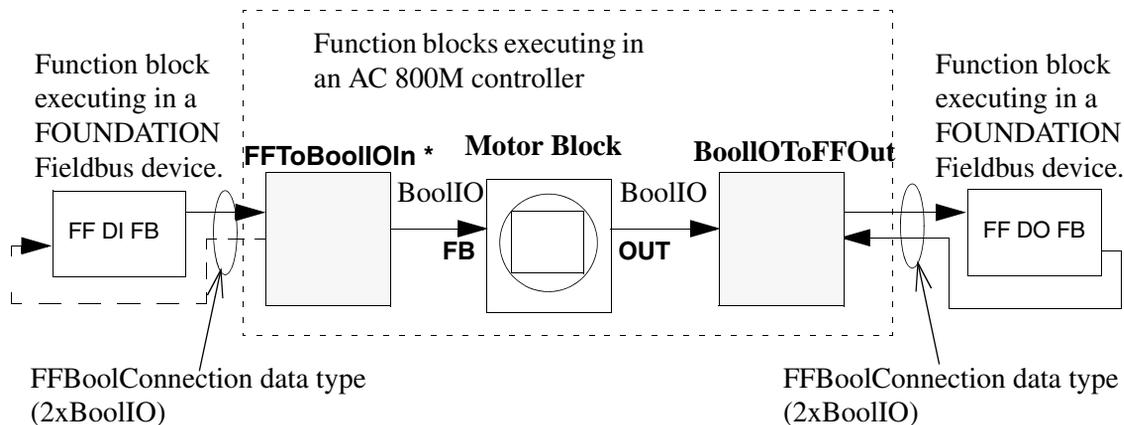
Figure 24. FFDWordConnection Data Type Structure

the structure of the FFDWordConnection data type. The forward component of the FFDWordConnection data type has to be mapped to a CI860 channel of DwordIO type. The Value and Status components of the FF signal are copied to the Value and Status component of the Out parameter of type DwordIO.

DwordIOTtoFFOut

The DwordIOTtoFFOut function block writes to the IN parameter of a discrete FOUNDATION Fieldbus output function block. The OUT parameter of the DwordIOTtoFFOut function block is of type FFDWordConnection. [Figure 24](#) shows the structure of the FFDWordConnection data type. The forward and backward

components of the FFDWordConnection data type have to be mapped to a CI860 channel of DwordIO type. The Value and Status components of the FF signal are copied from the Value and Status component of the IN parameter of type DwordIO.



* can be omitted by using the CI860 channel directly (BoolIO) since no backward signal is used.

Figure 25. Example of Typical Usage of FOUNDATION Fieldbus Digital Function Blocks

Application Programming for Client/Server Communication

This section describes the configuration to access and handle Client/Server signals in Control Builder applications. The signals are assigned to FOUNDATION Fieldbus block contained parameters from a H1 device and allow the access to them from applications running in the AC 800M controller.



Client/Server communication in the CI860 is not automatically controller style communication with same high priority and quick failure recovery as Publisher/Subscriber. It is an add-on functionality not designed for critical applications.

To reach Client/Server signals in Control Builder a connection to the according H1 device has to be established. For this connection and to read and write the Client/Server signals, the FFHSECommLib provides five function blocks which are described in the following subsections. These function blocks are:

- FFHSEConnect
- FFHSERead
- FFHSEReadCyc
- FFHSEWrite
- FFHSEWriteCyc

Client/Server signal mapping

Client/Server signals

Client/Server signals are configured and assigned to FF block parameters from Fieldbus Builder FF. Apart from the FF signals which are communicated via the Publisher/Subscriber communication, Client/Server signals are not visible in the CI860 Hardware Configuration Editor from Control Builder. In Control Builder the values of the Client/Server signals are read or written via the Client/Server specific function blocks described in the next section.

The assignment of a Client/Server signal to a FF block parameter is done in the Properties dialog of the FOUNDATION Fieldbus block out of Fieldbus Builder FF.

In this Properties dialog select in the folder Advanced the Properties item. On the right of the Properties dialog you will find now a column with the name C/S Signal Name. For detailed information concerning the configuration of Client/Server signals refer to *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)* manual.

A Client/Server signal enables the read and/or write access to FF parameters. The transmitted data is mapped to variables in Control Builder. [Table 21](#) gives an overview of the available data types, their elements and a description of the according Fieldbus Builder FF types.

Table 21. Control Builder data types for Client/Server communication

Control Builder data type	Control Builder data types elements	Description of FBB FF type
FFFloatDS8	Value (real) Dummy (int) - not used	Float (4 octets)
FFBitStrLen8DS14	Value (word) Dummy (int) - not used	Bit Enumerated (1 octet)
FFBitStrLen16DS14	Value (word) Dummy (int) - not used	Bit Enumerated (2 octets)
FFFloatStatusDS65	Status (dword) Value (real)	Enumerated (1 octet) Float (4 octets)
FFDiscreteStatusDS66	Status (dword) Value (uint)	Enumerated (1 octet) Enumerated (1 octet)

Statistic Channels

As for the Publisher/Subscriber communication, there are a number of statistic channels that supply diagnostic data on the Client/Server communication in online mode. Refer to [CI860 Statistic Channel](#) on page 88.

Function blocks for Client/Server communication

A connection to a H1 device is established with the FFHSEConnect function block. The connection will be available for communication function blocks (Read and Write function blocks) via the Comm_Channel ID given by the FFHSEConnect function block. These communication function blocks treats for the read and write actions of the Client/Server signals the data types listed in [Table 14](#). For further informations to Client/Server data types refer to [Data Types](#) on page 32 and to [Client/Server signals](#) on page 77.

[Table 22](#) gives a overview and a short description of all Client/Server function blocks supported by the FFHSECommLib.

Table 22. Library Objects for FOUNDATION Fieldbus HSE C/S Communication

Object name	Object type	Description
FFHSEConnect	Function block type	Establishes a connection to a H1 device and creates a Comm_Channel Id which represents the communication channel. With this Id the communication function blocks of type Read/Write can access the FF parameter(s).
FFHSERead	Function block type	Read Foundation Fieldbus function block parameter on request.
FFHSEReadCyc	Function block type	Read Foundation Fieldbus function block parameter cyclically. The cycle time is configurable.
FFHSEWrite	Function block type	Write Foundation Fieldbus function block parameter on request.
FFHSEWriteCyc	Function block type	Write Foundation Fieldbus function block parameter cyclically. The cycle time is configurable.

FFHSEConnect

To establish the connection to a H1 device the Device Tag of the device which was defined in Fieldbus Builder FF and the local communication channel (CEX bus slot number of the CI860 module) which should be used for the connection must be known. These informations are given to the parameters Channel and Device Tag of the FFHSEConnect function block. The parameter with the name Id must be forwarded to the Read/Write function blocks which should communicate with the H1 device. The FFHSEConnect function block has further parameters which allow to control the execution of this function block and gives informations concerning the communication. See [Figure 26](#) and [Table 23](#).

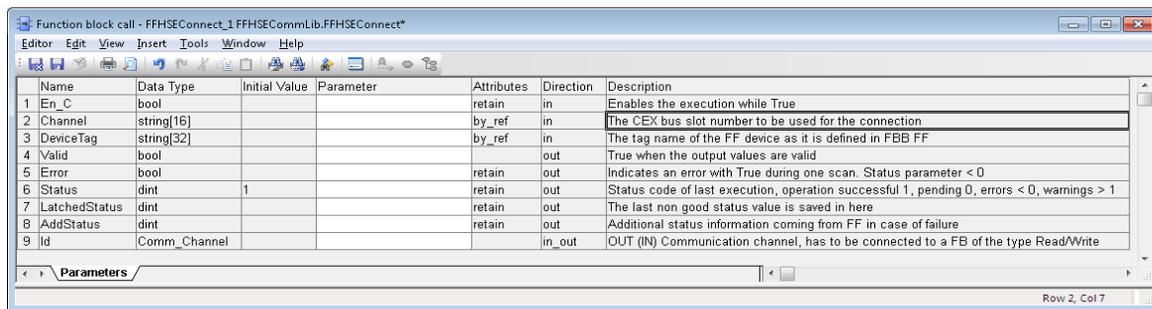


Figure 26. FFHSEConnect Parameter Dialog

Table 23. FFHSEConnect Parameters

Parameter	Data type	Direction	Description
En_C	bool	in	Enables the execution while True
Channel	string[16]	in	The CEX bus slot number to be used for the connection.
DeviceTag	string[32]	in	The tag name of the FF device as it is defined in Fieldbus Builder FF

Table 23. FFHSEConnect Parameters (Continued)

Parameter	Data type	Direction	Description
Valid	bool	out	True when the output values are valid
Error	bool	out	Indicates an error with True during one scan. Status parameter < 0
Status	dint	out	Status code of last execution, operation successful 1, pending 0, errors < 0, warnings > 1
LatchedStatus	dint	out	The last non good status value is saved in here
AddStatus	dint	out	Additional status information coming from FF in case of failure
Id	Comm_Channel	in_out	OUT Communication channel, has to be connected to the Read/Write function blocks

Read function blocks: FFHSERead, FFHSEReadCyc

For reading FF parameters, two types of read function blocks are supported. The first type is the FFHSERead function block which read a signal on a request. Therefore a positive edge at the input parameter Req is needed. The second type is the FFHSEReadCyc function block which read a signal cyclically with the time configured at the input parameter CycleTime.

Both types of the Read function blocks reads FF parameter, which is referenced at the input SignalName by the Client/Server signal. Only the name of the signal which was defined in Fieldbus Builder FF has to be given here. The value of this Client/Server Signal is given to the function block parameter Rd. The Control Builder variable which is mapped to this parameter has to be one of the data types

from [Table 21](#) (depending on the Fieldbus Builder FF type to which the Client/Server signal is assigned)

To reach the H1 device the Id parameter of the Read function block has to be connected to the Id parameter from the FFHSEConnect function block. Also the rest of the two Read function block parameters are nearly similar. See [Figure 27](#), [Figure 28](#) and [Table 24](#).

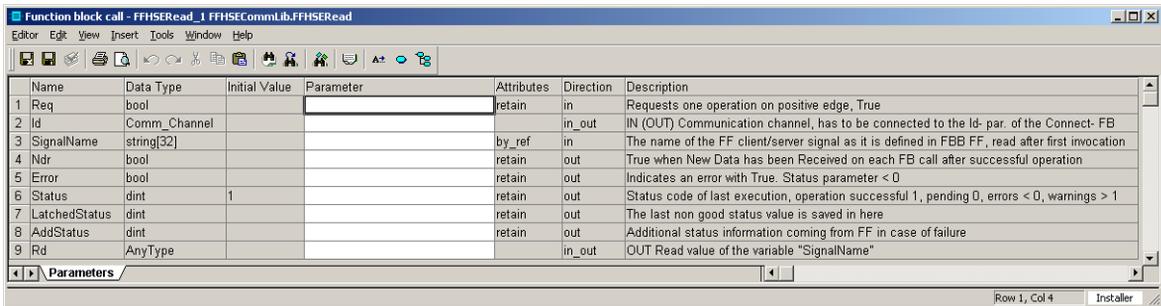


Figure 27. FFHSERead Parameter Dialog

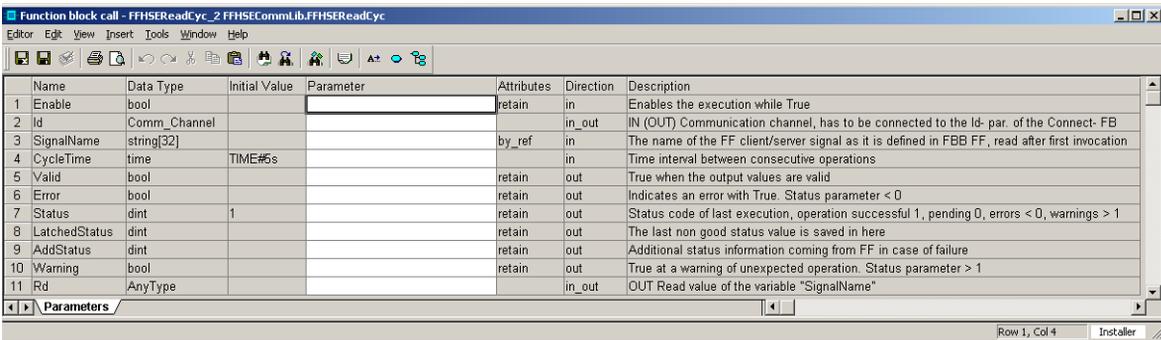


Figure 28. FFHSEReadCyc Parameter Dialog

Table 24. FFHSERead and FFHSEReadCyc Parameters

Parameter	Data type	Direction	Description
Enable (only for FFHSEReadCyc)	bool	in	Enables the execution and establishes connection to the H1 device while True
Id	Comm_Channel	in_out	IN Communication channel, has to be connected to the Id parameter of the FFHSEConnect function block
Req (only for FFHSERead)	bool	in	On a positive edge at this input, the FF parameter is read
CycleTime (only for FFHSEReadCyc)	time	in	Time interval between two read actions of the FF parameter.
SignalName	string[32]	in	The name of the Client/Server signal as it is defined in Fieldbus Builder FF
Ndr	bool	out	True when New Data has been received on each function block call after successful operation
Valid (only for FFHSEReadCyc)	bool	out	True when the connection is established
Error	bool	out	Indicates an error with True during one scan. Status parameter < 0
Status	dint	out	Status code of last execution, operation successful 1, pending 0, errors < 0, warnings > 1
LatchedStatus	dint	out	The last non good status value is saved in here
AddStatus	dint	out	Additional status information coming from FF in case of failure

Table 24. FFHSERead and FFHSEReadCyc Parameters (Continued)

Parameter	Data type	Direction	Description
Warning (only for FFHSEReadCyc)	bool	out	True at a warning of unexpected operation. Status parameter > 1
Rd	AnyType (see Table 21)	in_out	OUT Read value of the variable SignalName

Write function blocks: FFHSEWrite, FFHSEWriteCyc

FFHSEWrite writes a FF parameter on request (on a positive edge at the input parameter Req) and the FFHSEWriteCyc writes a FF parameter cyclically with the time configured at the input parameter CycleTime.

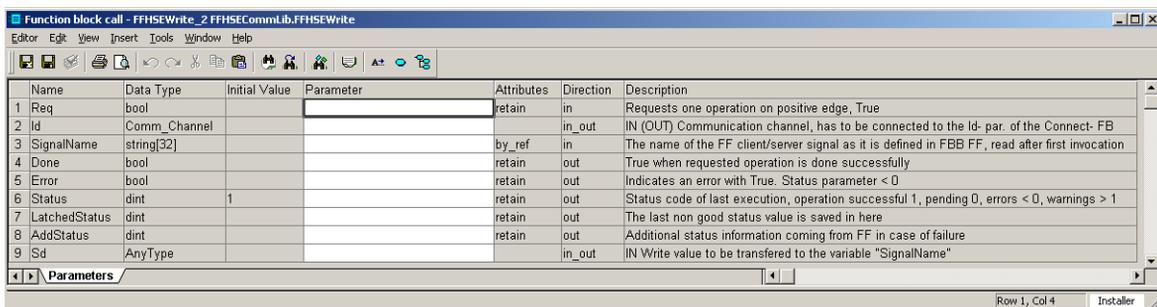


The cyclic write of static FF parameters has to be taken with care. There are FF devices for which the life cycle can be reduced through a too frequently writing of these parameters. If a static FF parameter is written via the FFHSEWriteCyc function block, the output parameter Status of the function block gives a error code with the value -7055 (see [Appendix B, CI860 Error Codes](#)).

It is possible to avoid this through a cyclic usage of the FFHSEWrite function block, but in this case the user has to take care that write accesses are reduced accordingly to the manufacturers specifications. To control if a static parameter is written to a FF device, every FF block provides at Index 1 the parameter ST_REV. This parameter increases by every write action to a static parameter. If a static parameter has to be written and it is not clear which cycle time is allowed, contact the device manufacturer or the ABB support.

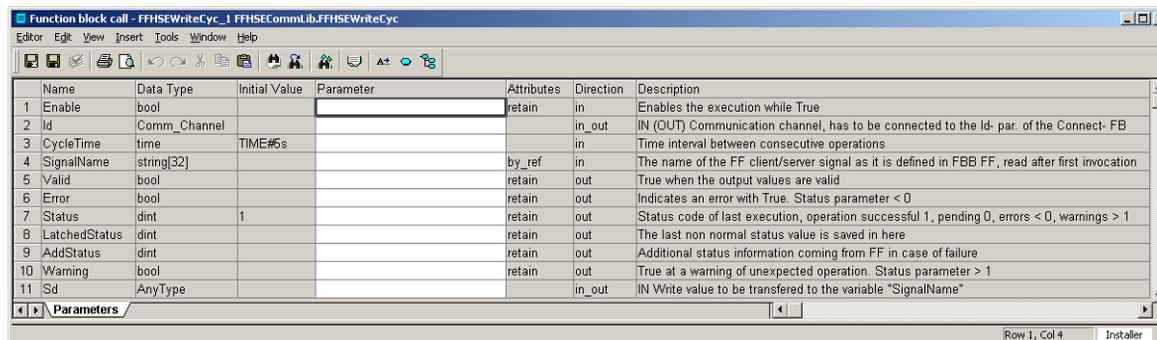
Both function blocks (FFHSEWrite and FFHSEWriteCyc) write FF parameter that are referenced at the input SignalName by the Client/Server signal. The value which should be written to the Client/Server signal is transferred from the parameter Sd. The Control Builder variable which is mapped to this parameter has to be one of the data types from [Table 21](#) (depending on the Fieldbus Builder FF type to which the Client/Server signal is assigned). To reach the H1 device the Id parameter of the function block has to be connected to the Id parameter from the FFHSEConnect

function block. As for the Read function blocks the rest of the two Write function blocks parameters are nearly similar. See [Figure 29](#), [Figure 30](#) and [Table 25](#).



Name	Data Type	Initial Value	Parameter	Attributes	Direction	Description
1 Req	bool			retain	in	Requests one operation on positive edge, True
2 Id	Comm_Channel				in_out	IN (OUT) Communication channel, has to be connected to the Id- par. of the Connect- FB
3 SignalName	string[32]			by_ref	in	The name of the FF client/server signal as it is defined in FBB FF, read after first invocation
4 Done	bool			retain	out	True when requested operation is done successfully
5 Error	bool			retain	out	Indicates an error with True. Status parameter < 0
6 Status	dint	1		retain	out	Status code of last execution, operation successful 1, pending 0, errors < 0, warnings > 1
7 LatchedStatus	dint			retain	out	The last non good status value is saved in here
8 AddStatus	dint			retain	out	Additional status information coming from FF in case of failure
9 Sd	AnyType				in_out	IN Write value to be transferred to the variable "SignalName"

Figure 29. FFHSEWrite Parameter Dialog



Name	Data Type	Initial Value	Parameter	Attributes	Direction	Description
1 Enable	bool			retain	in	Enables the execution while True
2 Id	Comm_Channel				in_out	IN (OUT) Communication channel, has to be connected to the Id- par. of the Connect- FB
3 CycleTime	time	TIME#5s			in	Time interval between consecutive operations
4 SignalName	string[32]			by_ref	in	The name of the FF client/server signal as it is defined in FBB FF, read after first invocation
5 Valid	bool			retain	out	True when the output values are valid
6 Error	bool			retain	out	Indicates an error with True. Status parameter < 0
7 Status	dint	1		retain	out	Status code of last execution, operation successful 1, pending 0, errors < 0, warnings > 1
8 LatchedStatus	dint			retain	out	The last non normal status value is saved in here
9 AddStatus	dint			retain	out	Additional status information coming from FF in case of failure
10 Warning	bool			retain	out	True at a warning of unexpected operation. Status parameter > 1
11 Sd	AnyType				in_out	IN Write value to be transferred to the variable "SignalName"

Figure 30. FFHSEWriteCyc Parameter Dialog

Table 25. FFHSEWrite and FFHSEWriteCyc Parameters

Parameter	Data type	Direction	Description
Enable (only for FFHSEWriteCyc)	bool	in	Enables the execution while True
Id	Comm_Channel	in_out	IN Communication channel, has to be connected to the Id parameter of the FFHSEConnect function block
Req (only for FFHSEWrite)	bool	in	On a positive edge of this input, the FF parameter is written
CycleTime (only for FFHSEWriteCyc)	time	in	Time interval between two write actions of the FF parameter
SignalName	string[32]	in	The name of the Client/Server signal as it is defined in Fieldbus Builder FF
Sd	AnyType (see Table 21: Control Builder data types for Client/Server communication)	in_out	IN Write value to be transferred to the variable SignalName
Done (only for FFHSEWrite)	bool	out	True when requested operation is done successfully
Valid (only for FFHSEWriteCyc)	bool	out	True when the output values are valid
Error	bool	out	Indicates an error with True during one scan. Status parameter < 0

Table 25. FFHSEWrite and FFHSEWriteCyc Parameters (Continued)

Parameter	Data type	Direction	Description
Status	dint	out	Status code of last execution, operation successful 1, pending 0, errors < 0, warnings > 1
LatchedStatus	dint	out	The last non good status value is saved in here
AddStatus	dint	out	Additional status information coming from FF in case of failure
Warning (only for FFHSEWriteCyc)	bool	out	True at a warning of unexpected operation. Status parameter > 1

CI860 Statistic Channel

The CI860 Hardware Configuration Editor provides in the Connections tab (see [Figure 18](#)) all I/O channels for signals which are communicated via Publisher/Subscriber communication. Apart from the I/O channels, there are a number of statistic channels that supply diagnostic data on the CI860, the Publisher/Subscriber and the Client/Server communication in online mode. These channels are always available, for example they need no special FF signal mapping in Fieldbus Builder FF. In Control Builder variables must be mapped to these I/O channels to be able to view diagnostic data in online mode. Refer to [Online Data](#) on page 92. [Table 26](#) provides information on the available data.

Table 26. CI860 Statistic Channels

Channel	Name	Description
IW1.6500	No of HSE publisher	Accumulated number of published HSE signals.
IW1.6501	No of HSE subscriber	Accumulated number of subscribed HSE signals.
IW1.6502	CPU load	CPU load of CI860. The limit is given by 100% but the value of 80% shall not be exceeded.
IW1.6503	No of send failed	Number of datagrams on HSE subnet failed to send. For future use as it is not relevant for UDP communication.
IW1.6504	No of exp. stall count	Number of datagrams on HSE subnet not processed in specified period of time (cycle time*stall count, stall count default=4). For detailed information, refer to the FOUNDATION Fieldbus specifications.
IW1.6505	Average FF load	Average load for CI860 on HSE subnet caused by published and subscribed signals. If the limit of 100% is indicated, the FF load has to be lowered. Reduce the number of signals per second for this unit in Fieldbus Builder FF. Reduce the number of configured signals or increase the cycle time for the signals.

Table 26. CI860 Statistic Channels (Continued)

Channel	Name	Description
IW1.6506	UDP received w/o processing	Number of UDP datagrams received that were not intended for this CI860 module. Any deviation from zero is an indicator of a configuration problem.
IW1.6507	Reserved 2	Reserved for internal purpose.
IW1.6508	Reserved 3	Reserved for internal purpose.
IW1.6509	No Clt/Srv requests	Accumulated number of Client/Server requests.
IW1.6510	No Clt/Srv reads	Accumulated number of successful Client/Server Read transaction.
IW1.6511	No Clt/Srv writes	Accumulated number of successful Client/Server Write transactions.
IW1.6512	No Clt/Srv reads failed	Accumulated number of failed Client/Server Read transaction. Any increment is an indicator of a communication problem.
IW1.6513	No Clt/Srv writes failed	Accumulated number of failed Client/Server Write transactions. Any increment is an indicator of a communication problem.
IW1.6514	No Clt/Srv connects	Accumulated number of successful Client/Server Connection Establishment transactions.
IW1.6515	No Clt/Srv connects failed	Accumulated number of failed Client/Server connection establishment transactions. Any increment is an indicator of a communication problem.
IW1.6516	No Clt/Srv connection aborts	Accumulated number of received connection abort indications. Any increment is an indicator of a communication problem.
IW1.6517	Reserved 3	Reserved for internal purpose.
IW1.6518	UnitStatus	(Status of the CI module with elements that are generic for all CI modules and CI860 specific parts as defined in HWD file)

Section 4 Download and Online Mode

The whole configuration data of the CI860 including the FF configuration is downloaded to the AC 800M from the Control Builder during the normal download procedure.

This data includes information about FF signals connected to the CI860. These connections are set up in the Fieldbus Builder FF and are fetched by the Control Builder before download to the controller. All downloads to the CI860 are handled by the Control Builder. All FF configuration data of other FF devices is downloaded by the Fieldbus Builder FF.

Precondition

Firmware Upgrade

Before you can download the AC 800M controller ensure that the processor module as well as the CI860 contain the correct firmware. Refer to Control Builder documentation and online help for further information.

Download FF HSE Subnet Configuration

To be able to read and write FOUNDATION Fieldbus data in the AC 800M controller the Fieldbus Builder FOUNDATION Fieldbus configurations have to be downloaded to the HSE subnet(s) first.

This invokes the following steps in Fieldbus Builder FF:

1. **Check**



If you have carried out this step without any listed errors, you may download the controller in parallel. Anyhow you will not get any FF live data until you have carried out the next steps.

2. **Prepare for commissioning of the FF Linking Device**
The FF Linking Device is initialized and addresses are assigned.
3. **Assign H1 devices**
For each H1 link:
Each device actually present in the H1 link live list is assigned to a configured device.
4. **Load H1 link**
All devices on the H1 link are loaded along with their configuration data.

Download CI860 Configuration and Controller Application

The Control Builder gathers the CI860 configurations from Fieldbus Builder FF and loads the settings together with Controller Application(s) during project download into the controller. After a successful download the Control Builder stores the downloaded CI860 configuration persistently. During the next download sequence the last successfully downloaded CI860 configuration is compared with the current CI860 configuration requested from the Fieldbus Builder FF. If changes are detected the new CI860 configuration be downloaded to the controller.

During download of the CI860 configuration the IEC 61131 user application will be stopped shortly.

Online Data

This section describes how to access CI860 and Control Application data online in Control Builder. To access FF HSE Subnet data online with Fieldbus Builder FF, refer to *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)* manual.

CI860 Online

In online mode the Hardware Configuration Editor of the CI860 module gives online informations on the CI860 channels.

1. Double click on the CI860 or choose **Editor** from the CI860 context menu to open the editor.
2. Choose the Properties tab (see [Figure 31](#)). This tab is only available in online mode as the contained scaling information is configured in the FF devices.

Channel	Variable	Min	Max	Unit	Fraction	Inverted	Protocol Info
QW1.0	Application_1_D14AOIN	0.0	100.0		1		D14AOIN
QW1.1	Application_1_D10AOIN	0.0	100.0		1		D10AOIN
QX1.1024	Application_1_D13TRKIN_B						D13TRKIN
QW1.1025							D13TRKIN
QX1.1026							D9SIN1D
QW1.1027	Application_1_D9SIN1D_D						D9SIN1D
IW1.3072	Application_1_D1A1Out	0.0	100.0		1		D1A1Out
IW1.3073	Application_1_D2A1Out	0.0	100.0		1		D2A1Out
IW1.3074	Application_1_D3A1Out	0.0	100.0		1		D3A1Out
IW1.3075	Application_1_D4A1Out	0.0	100.0		1		D4A1Out
IW1.3076	Application_1_D5A1Out	0.0	100.0		1		D5A1Out
IW1.3077	Application_1_D7A1Out	0.0	100.0		1		D7A1Out
IW1.3079	Application_1_D14AOBKO	0.0	100.0	%	1		D14AOBKO
IW1.3080	Application_1_D10BKO	0.0	100.0	%	1		D10BKO
IW1.3081	Application_1_D14A00OUT	0.0	100.0		1		D14A00OUT
IW1.3082	Application_1_D8A1Out	0.0	100.0		1		D8A1Out
IW1.3083	Application_1_D6A1Out	0.0	100.0		1		D6A1Out
IX1.4096	Application_1_D9A1OUTD_B						D9A1OUTD
QW1.4097	Application_1_D9A1OUTD_D						D9A1OUTD
IW1.6500	Application_1_CI1_HSEPub						Extended status
IW1.6501	Application_1_CI1_HSESub						Extended status
IW1.6502	Application_1_CI1_CPULoad						Extended status
IW1.6503	Application_1_CI1_SendFail						Extended status
IW1.6504	Application_1_CI1_ExpStall						Extended status
IW1.6505	Application_1_CI1_AvFFLoad						Extended status
IW1.6506	Application_1_CI1_UDPwoProc						Extended status
IW1.6507	Application_1_CI1_Res2						Extended status
IW1.6508	Application_1_CI1_Res3						Extended status
IW1.6509	Application_1_CI1_CSReq						Extended status
IW1.6510	Application_1_CI1_CSRead						Extended status
IW1.6511	Application_1_CI1_CSWrite						Extended status
IW1.6512	Application_1_CI1_CSReadFail						Extended status
IW1.6513	Application_1_CI1_CSWriteFail						Extended status
IW1.6514	Application_1_CI1_CSConnects						Extended status
IW1.6515	Application_1_CI1_CSConnFail						Extended status
IW1.6516	Application_1_CI1_CSAborts						Extended status
IW1.6517	Application_1_CI1_Res1						Extended status

Figure 31. CI860 Properties Tab in Online Mode

In the Properties tab the following information is displayed for each channel:

- Variable
 - Min, Max, Unit, Fraction
 - Inverted
 - Protocol Info
3. Choose the Status tab (see [Figure 32](#)) to get online information on the CI860 channels. The following information is displayed for each channel:
- Channel value
 - Forced
 - Variable value
 - Variable
 - Protocol Info

Forcing the channels is possible. For details, refer to the Control Builder documentation. This tab also contains diagnostic data and information on the status of the FF HSE and Client/Server communication. For further information on the status of FF HSE communication, refer to [CI860 Statistic Channel](#) on page 88.

Channel	Channel Value	Forced	Variable Value	Variable	Protocol Info
QW1.0	12.3	<input type="checkbox"/>	12.3	Application_1_D14AOIN	D14AOIN
QW1.1	56.8	<input type="checkbox"/>	56.8	Application_1_D10AOIN	D10AOIN
QX1.1024	true	<input type="checkbox"/>	true	Application_1_D13TRKIN_B	D13TRKIN
QW1.1025		<input type="checkbox"/>			D13TRKIN
QX1.1026		<input type="checkbox"/>			D9ISIN1D
QW1.1027	123	<input type="checkbox"/>	123	Application_1_D9ISIN1D_D	D9ISIN1D
IW1.3072	-1.9	<input checked="" type="checkbox"/>	-1.9	Application_1_D1AI1Out	D1AI1Out
IW1.3073	26.3	<input checked="" type="checkbox"/>	26.3	Application_1_D2AI1Out	D2AI1Out
IW1.3074	58.7	<input type="checkbox"/>	58.7	Application_1_D3AI1Out	D3AI1Out
IW1.3075	16.5	<input type="checkbox"/>	16.5	Application_1_D4AI1Out	D4AI1Out
IW1.3076	11.0	<input type="checkbox"/>	11.0	Application_1_D5AI1Out	D5AI1Out
IW1.3077	61.0	<input type="checkbox"/>	61.0	Application_1_D7AI1Out	D7AI1Out
IW1.3079	12.3	<input type="checkbox"/>	12.3	Application_1_D14AOBK0	D14AOBK0
IW1.3080	0.0	<input type="checkbox"/>	0.0	Application_1_D10BK0	D10BK0
IW1.3081	12.3	<input type="checkbox"/>	12.3	Application_1_D14AOOUT	D14AOOUT
IW1.3082	37.0	<input type="checkbox"/>	37.0	Application_1_D6AI1Out	D6AI1Out
IW1.3083	18.4	<input type="checkbox"/>	18.4	Application_1_D6AI1Out	D6AI1Out
IX1.4096	false	<input type="checkbox"/>	false	Application_1_D9AIOUTD_B	D9AIOUTD
IW1.4097	0	<input type="checkbox"/>	0	Application_1_D9AIOUTD_D	D9AIOUTD
IW1.6500	1390796	<input type="checkbox"/>	1390796	Application_1_C11_HSEPub	Extended status
IW1.6501	4155716	<input type="checkbox"/>	4155716	Application_1_C11_HSESub	Extended status
IW1.6502	12	<input type="checkbox"/>	12	Application_1_C11_CPULoad	Extended status
IW1.6503	0	<input type="checkbox"/>	0	Application_1_C11_SendFail	Extended status
IW1.6504	347742	<input type="checkbox"/>	347742	Application_1_C11_ExpStall	Extended status
IW1.6505	15	<input type="checkbox"/>	15	Application_1_C11_AvFFLoad	Extended status
IW1.6506	0	<input type="checkbox"/>	0	Application_1_C11_UDPwoProc	Extended status
IW1.6507	7	<input type="checkbox"/>	7	Application_1_C11_Res2	Extended status
IW1.6508	3	<input type="checkbox"/>	3	Application_1_C11_Res3	Extended status
IW1.6509	10303	<input type="checkbox"/>	10303	Application_1_C11_CSReq	Extended status
IW1.6510	0	<input type="checkbox"/>	0	Application_1_C11_CSRead	Extended status
IW1.6511	0	<input type="checkbox"/>	0	Application_1_C11_CSWrite	Extended status
IW1.6512	0	<input type="checkbox"/>	0	Application_1_C11_CSReadFail	Extended status
IW1.6513	0	<input type="checkbox"/>	0	Application_1_C11_CSWriteFail	Extended status
IW1.6514	0	<input type="checkbox"/>	0	Application_1_C11_CSConnects	Extended status
IW1.6515	10303	<input type="checkbox"/>	10303	Application_1_C11_CSConnFail	Extended status
IW1.6516	0	<input type="checkbox"/>	0	Application_1_C11_CSAborts	Extended status
IW1.6517	0	<input type="checkbox"/>	0	Application_1_C11_Res1	Extended status

Figure 32. CI860 Status Tab in Online Mode

- Choose the Unit Status tab (see [Figure 33](#)) to get online information on the hardware status of the CI860 module. For details, refer to the Control Builder documentation.

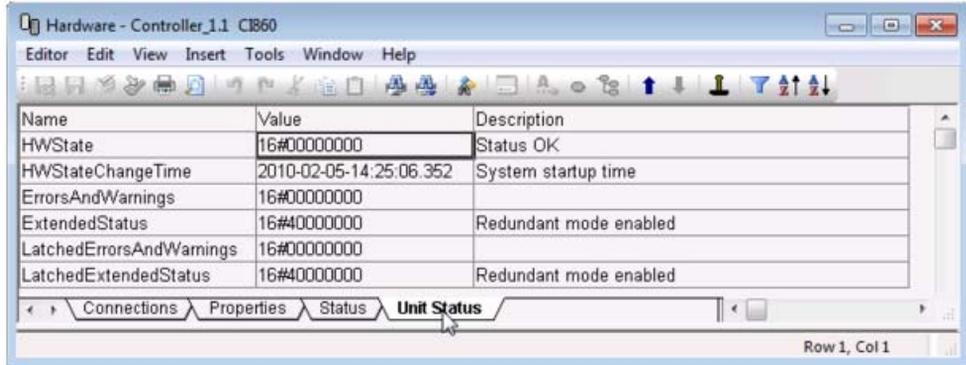


Figure 33. CI860 Unit Status Tab in Online Mode

Control Application Online

Open your application (see [Figure 34](#)) to get detailed information on all variables used in your application. This includes forward and backward components of the FF data types as well as status and forced information and FF parameters

Name	Current Value	Data Type	Attributes	Initial Value	I/O Address	I/O Description
Templn1		FFRealConnection	retain			
PressureIn1		FFRealConnection	retain			
Out1		FFRealConnection	retain			
Forward		RealIO	retain		Controller21.1.0	
Value	46.386	real	retain			
IOValue	46.386	real	retain			
Forced	false	bool	retain			
Status	16#C00000C0	dword	retain	16#C0		
Parameters		SignalPar				
Max	100.0	real	retain	100.0		
Min	0.0	real	retain	0.0		
Invert	false	bool	retain			
Fractio	1	dint	retain	1		
Unit		string[10]	retain	"		
Backward		RealIO	retain		Controller21.1.3076	
Value	98.296	real	retain			
IOValue	98.296	real	retain			
Forced	false	bool	retain			
Status	16#CC0000CC	dword	retain	16#C0		
Parameters		SignalPar				
Mod1NoHSE	21722	dint	retain		Controller21.1.6500	
Mod1NoHSE	811	dint	retain		Controller21.1.6501	
Mod1NoHSE	1	dint	retain		Controller21.1.6502	

Figure 34. Application in Online Mode

Section 5 Configuration Changes

This section gives informations and describes how to handle configuration changes in Fieldbus Builder FF and Control Builder. Changes should be taken with care.



The complete configuration is downloaded in two steps from Fieldbus Builder FF and Control Builder. For this reason it is possible to create inconsistent data to the FF network and to the controllers!

Before downloading your controller(s) from Control Builder, ensure that the Fieldbus Builder FF configuration that was or is to be downloaded is plausible/checked and saved.

Be aware that for a consistent configuration it is necessary that both downloads from Fieldbus Builder FF as well as from Control Builder have been completed.

The Control Builder fetches the plausible/checked CI860 HSE configuration from the last saved HSE subnet configuration. In the case of configuration changes in Fieldbus Builder FF which not include or affect the CI860 HSE host object the configuration for the CI860 in Control Builder remains the same and the controller does not need to be loaded again. Only the changed configuration of the HSE subnet has to be downloaded from Fieldbus Builder FF.

In the case that the configuration of the CI860 HSE host object are changed follow this workflow:

1. Plausible/check and save the CI860 HSE Host configuration in Fieldbus Builder FF.

2. Download the configuration from Control Builder and Fieldbus Builder FF. Download from both systems can be started in parallel as soon as the CI860 HSE Host configuration is plausible/checked and saved.



Ensure that both configurations, from Fieldbus Builder FF and Control Builder are downloaded. The period of time between the HSE subnet download from Fieldbus Builder FF on the one hand and the download from Control Builder to the controller(s) on the other hand should be kept as short as possible.

3. Check your configuration and applications in online mode of Control Builder and Fieldbus Builder FF.

Control Builder cannot check whether or not a HSE Subnet configuration has been downloaded. Due to this fact the gathered information does not necessarily match a configuration that was downloaded to the HSE subnet. Deviating from the recommended workflow can cause inconsistencies between downloaded configurations.

The consequences of downloaded configurations being inconsistent depend also on how the control loops are designed: Control loops may be run distributed on the FF network. They may run completely or partly on the controller(s). In the event that control loops are not run exclusively on the FF network, control loops may be interrupted as long as only parts of the overall configuration have been downloaded.

CI860 IP Address Change



If the IP address or subnet mask for a CI860 is changed and downloaded to the CI860, a reset on the CI860 will be performed automatically. The new settings will become effective after this reset.

If the IP address or subnet mask for a CI860 operating in redundant mode is changed the reset will be performed automatically as well. If the reset is performed for the CI860 currently working as primary module, a fail over to the backup module is performed.

If the reset is performed in the CI860 currently working as backup module, the primary module is not effected.

If the reset has to be performed on both modules, the module, which is configured in Control Builder as the primary (module A, see [Figure 9](#) for details), will act as the primary module after re-configuration. Because of the re-configuration of primary and backup module the HSE communication is interrupted during the IP address or subnet mask changes.

Section 6 CI860 Webserver

The CI860 Foundation Fieldbus HSE interface provides additional functionalities through a Webserver Interface. These functionalities are used for commissioning or maintenance.

CI860 Web Server Login Prerequisite

The web server interface can be accessed through web browsers such as Microsoft Internet Explorer or Mozilla Firefox. Before logging into web server, ensure that the following web browser settings are done in **Internet Options > Security** tab.



It is recommended to connect to web server from Windows 8 client machine. The browser setting changes in *Internet Options > Security* tab is only done to connect from a Windows 2012 R2 server.



Ensure the correctness of the browser settings for the connection (for example no proxy server for the controller address), are correct and that the controller should be accessible from the system.



Check if TCP/IP forwarding is enabled on Connectivity Servers. For more information, refer to *System 800xA Configuration (3BSE034463*)* manual.

Web Server Login



It is recommended to connect to web server from Windows 8 client machine. The browser setting changes in *Internet Options* > *Security* tab is only done to connect from a Windows 2012 R2 server.

To overcome unsuccessful login attempt into web server, open **Internet Options** and in the **Security** tab, ensure that for all the three zones (Internet, Local Intranet, and Trusted Sites), **Enable Protected Mode (requires restarting Internet Explorer)** check box is cleared as shown in [Figure 35](#).

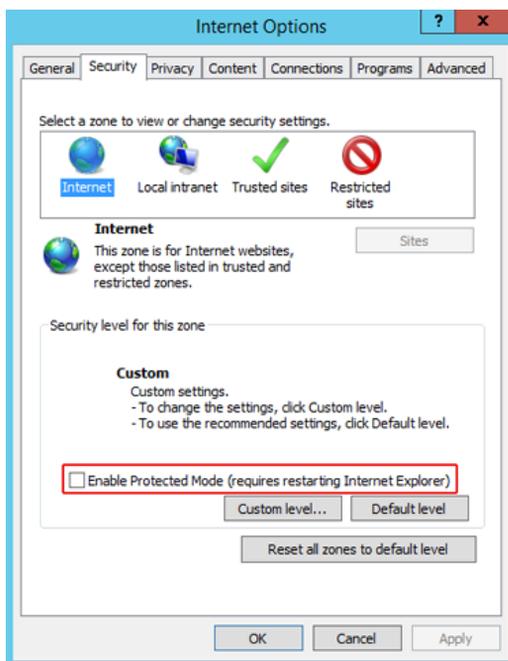


Figure 35. Internet Options - Security Tab, Zone Settings

Enable Javascript for Web Server



It is recommended to connect to web server from Windows 8 client machine. The browser setting changes in *Internet Options* > *Security* tab is only done to connect from a Windows 2012 R2 server.

To enable the javascript for using the web server, open **Internet Options** and click **Custom Level** in the **Security** tab, as shown in sample [Figure 36](#).

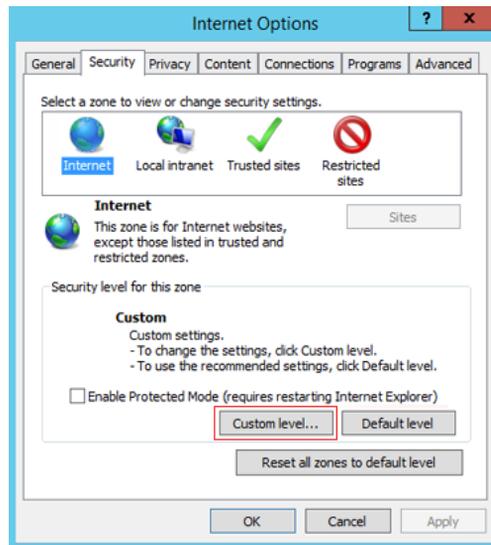


Figure 36. Internet Options - Security Tab

In the Security Settings, for **Scripting** and **Scripting of Java applets**, select the **Enable** option as shown in sample [Figure 37](#).

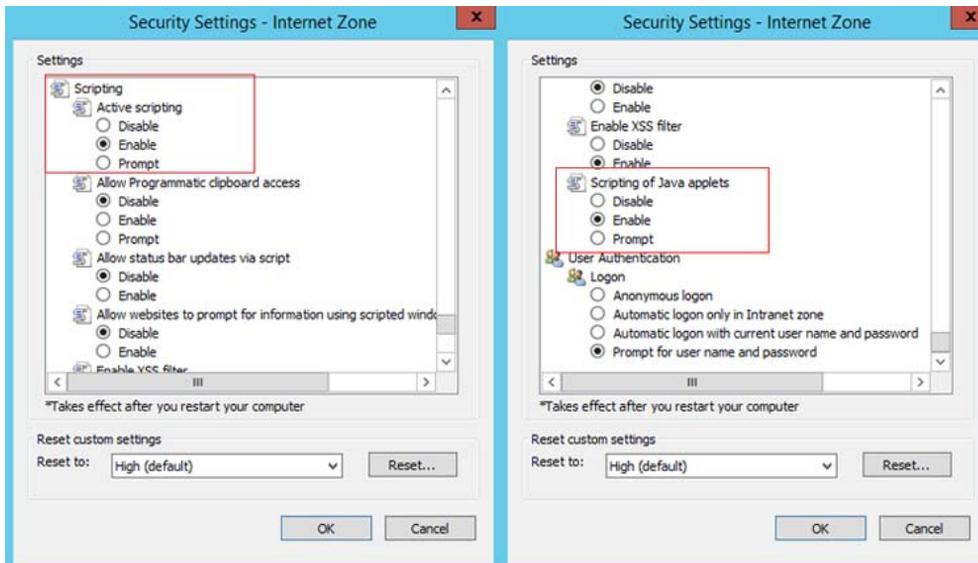


Figure 37. Custom Level Security Settings - Enable Javascript



Ensure that the same settings are done for all three zones (Internet, Local Intranet, and Trusted Sites).

Reset Web Browser Security settings for Web Server

The web browser settings mentioned in the [Web Server Login](#) on page 104 and [Enable Javascript for Web Server](#) on page 105 must be retained to its original settings after logging out of web server. This reset is done by manually changing the settings in all the three zones (*Internet, Local Intranet, and Trusted Sites*)

CI860 Web Server Security

The web server is disabled by default. It can be enabled on request using the **Enable Web Server** option available in the Control Builder. This option is visible only when the Control Builder is online and at least one of the modules CI854, CI860 and CI871 is configured

For more information on accessing the enable web server option in Control Builder and general handling of web server in controller, refer to the *System 800xA Control AC 800M Configuration (3BSE035980*)* manual.

The login screen for authentication is displayed as shown in [Figure 38](#). Enter the user name and password to login and access the home page of the web server. The default user name is `service` and the default password is **ABB800xA**. To change the password please refer to [Change Password](#) on page 122.

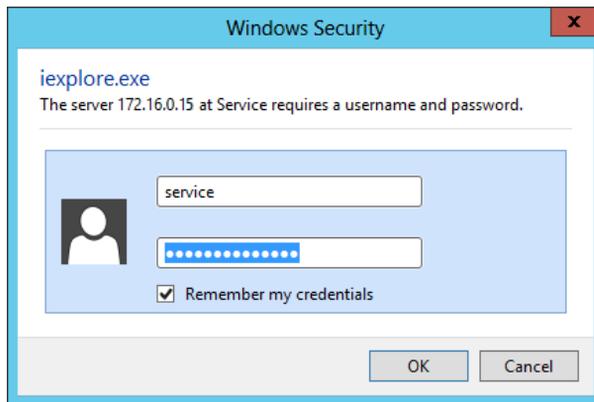


Figure 38. CI871 Webserver Login Authentication



The default password is **ABB800xA**. Replace this with a password that conforms with your organization's security policy at the first possible opportunity. Failure to replace the default password makes the system susceptible to unauthorized access.

Refer to the Password Security topic in *System 800xA Administration and Security (3BSE037410*)* for recommendations on establishing a password security scheme.

-  After firmware update to system version 6.0, the PM8xx controller password must be configured again, as the previously configured password is cleared and replaced with the new default password.
-  If three unsuccessful login attempts occur in a minute, the webserver is locked and can be logged in only after ten minutes.

After opening the web server Interface, select the required CI860 from the **Cex slot** drop-down list.

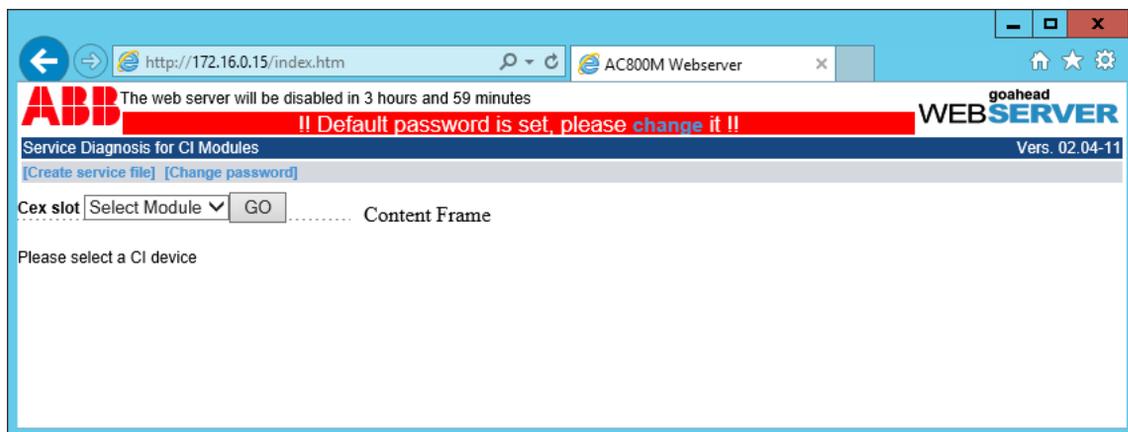


Figure 39. Starting Web Interface for CI860 Service Diagnosis

The web server page is active only for 4 hours from the first login. A timer is set for 4 hours and during this limited session time, an information on the remaining time before the web server disables is shown in the browser.

When the limited activation time has expired and if the web server page is still open, a message *The web server is disabled, it can only be re-enabled externally* is shown. To continue using the web server, enable it through Control Builder.

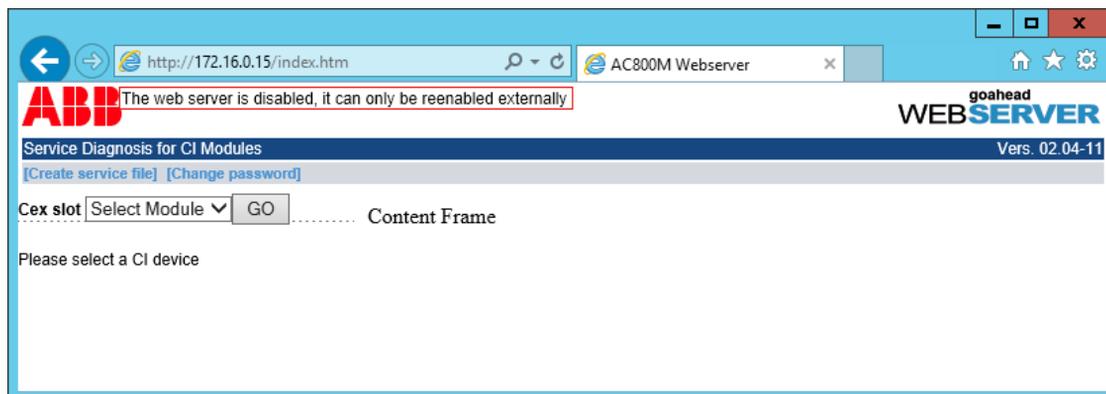


Figure 40. Web Server Disabled

Table 27 lists the Alarms, Events and Warnings recorded in web server. These are displayed in Plant Explorer and Hardware Status of Control Builder.

Table 27. Web server Alarms and Events

Message	Type	Severity
The web server is enabled, but the password has not been changed from default.	Alarm	Medium
The web server has been enabled.	Event	Low
The web server has been disabled.	Event	Low
The web server timer has been reset.	Event	Low
The controller password has been changed from.	Event	Low
Successful login to the controller from <IP>.	Event	Low
Unsuccessful login attempt to the controller from <IP>.	Event	Medium
Unsuccessful attempt for controller password change from <IP>.	Event	Medium
The web server has been enabled.	Audit Trail	N/A

CI860 Web Server Interface

The web server interface can be accessed through a web browser. To open the web server interface, enter the IP address of the controller in the address bar of the browser and press <Enter>.

The browser window has two frames. The left frame displays the menu items (Function List). Select the menu item on the left to display the respective contents in the content frame on the right.

The view of the menu is function specific. For certain menu items, only a simple view of the available data is displayed. Some menu items need an additional input before the corresponding data is displayed. An input dialog appears on the top of the content frame for these menu items.

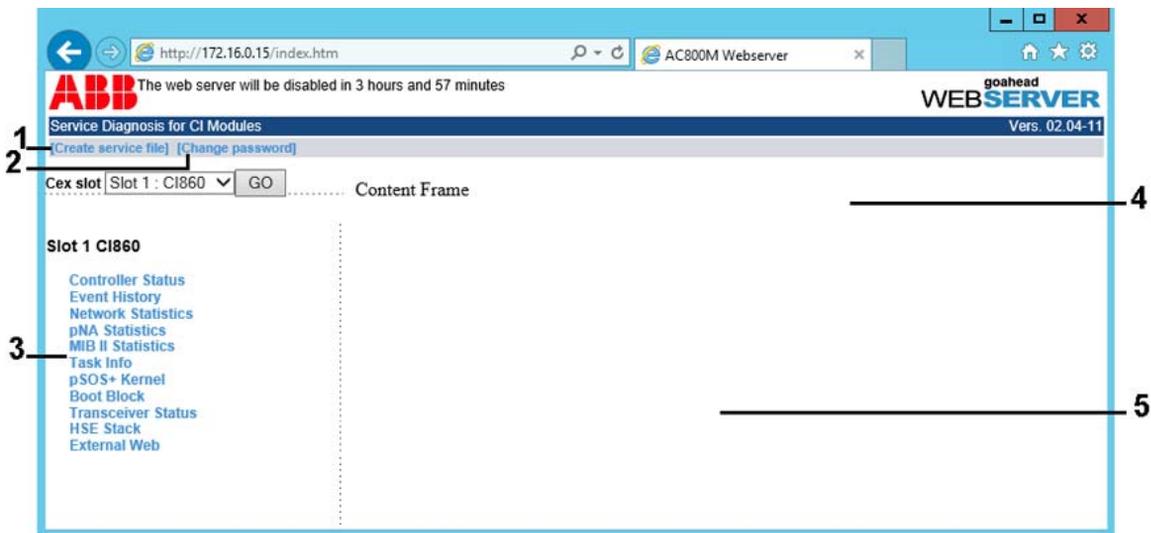


Figure 41. Functional overview of the Service Diagnosis

Legend	Description
1	Create Service File
2	Change Password

Legend	Description
3	Function List
4	Input Dialog
5	Content Frame

CI860 Web Interface Menu Items

CI860 Web Interface displays the following menu items:

- Controller Status
- Event History
- Network Statistics
- pNA Statistics
- MIB II Statistics
- Task Info
- pSOS+ Kernel
- Boot Block
- Transceiver Status
- HSE Stack
- External Web



External Web menu is only used by support personal.

Following chapters explains some important functions of the CI860 web server:

Controller Status

The **Controller Status** page displays the status of the CI860. The following information can be seen in the controller status page:

- Redundancy status
- Application
- Device Info
- Production Info
- Processor Info
- Memory Info
- IP Parameters
- Ethernet Configuration
- Operating System

The screenshot shows the ABB AC800M Webserver interface. The browser address bar indicates the URL is `http://172.16.0.15/index.htm`. The page title is "Service Diagnosis for CI Modules" and the version is "Vers. 02.04-11". The main content area is titled "Controller Status" and displays the following information:

```

Current Date and Time : Fri Apr 11 11:10:01 2014

Operating Time      : 1232 days 20 hours 32 minutes
Up Time           : 4 days 1 hours 2 minutes 11 seconds
CPU Load filtered  : 11%
CPU Load not filtered : 10%
Redundancy state   : REDUNDANCY_STATE_PRIMARY (RED)   HBMI_STATE_PRIMARY

Application
Application : Sample Application
Vendor      : ABB Automation Products
Model       : CI860
Revision    : 1.00 Alpha
Build       : Oct 08 2012 12:04:46
Version     : 05.172
Build Index : 8432

Device Info
Vendor Name      : ABB
Device Type      : CI860K01
Order Number     : 3BSE032444R1
Serial Number    : 09220COU
Hardware Version : 0500
Product Revision : J
Customer Version : 0000

Production Info
Production Date  : 20090609
Test Place      : 0001

Processor Info
Processor        : NETARM 50 (ARM7TDMI Core)
Chip Revision    : 27

Memory Info
Flash Memory Size : 2 MByte
SDRAM Memory Size : 8 MByte
Shared Memory Size : 1 MByte
Flash Memory Used : 1225512 Bytes (58.437%)

IP Parameters (Serial EEPROM)
IP Address       : 192.016.000.051
Subnet Mask      : 255.255.252.000
Default Gateway  : 192.016.000.001

Ethernet
Address          : 00:00:23:0A:8C:10
Speed            : 100 Mbit/s
Mode             : Full Duplex
Polarity         : Normal
Medium           : Twisted Pair
Auto Negotiation Mode
Phy Id           : 0x000004DE (Level One)
Phy Model        : 0x000E (LXT971)
Phy Revision     : 0x0002

Operating System
pSOS+ Version    : pSOS+/ARM/LE V2.5.6

```

Figure 42. CI860 Controller Status

Event History

The **Event History** page displays the event history of CI860. High severity events are stored non volatile on CI860.

The screenshot shows the ABB AC800M Webserver interface. The browser address bar indicates the URL is http://172.16.0.15/index.htm. The page title is 'Service Diagnosis for CI Modules'. The main content area is titled 'Event History' and shows the following information:

Cex slot: Slot 1 : CI860

Slot 1 CI860

- Controller Status
- Event History
- Network Statistics
- pNA Statistics
- MIB II Statistics
- Task Info
- pSOS+ Kernel
- Boot Block
- Transceiver Status
- HSE Stack
- External Web

ErrorFifo: Remote boot 0.0.00 0:07:12.000

ErrorFifo Copy:

Number of Fatal Error Log Entries : 9

Error Code	Addt. Error Info	Task Name	Time
0x10012015	0x00000000	ISR	Tue Jan 5 07:06:44 2010
0x10012012	0x03C46C9C	XCPT	Thu Apr 1 04:37:08 2010
0x00002711	0x00000000	chkt	Wed Jul 14 10:44:27 2010
0x10012015	0x00000000	ISR	----
0x10012015	0x00000000	ISR	----
0x10012012	0x0020673C	XCPT	Tue Aug 28 08:39:00 2012
0x10012012	0x002195F8	XCPT	Mon Nov 26 10:59:21 2012
0x10012012	0x002196C8	XCPT	Sat Nov 30 04:58:28 2013
0x10012015	0x00000000	ISR	Wed Feb 26 06:02:49 2014

Figure 43. CI860 Event History

MIB II Statistics

MIB II Statistics lists the Ethernet statistics of CI860 as defined by the generic MIB II definition. Statistics of TCP settings, IP-Address assignments, ICMP open port messages are listed in this page.

The screenshot shows a web browser window with the address bar containing 'http://172.16.0.15/index.htm'. The page header includes the ABB logo and a notification: 'The web server will be disabled in 3 hours and 53 minutes'. The main content area is titled 'MIB II Statistics' and displays the following data:

```

=====
TCP Retransmission Algorithm : 4
TCP Minimum Retransmission Timeout : 1000
TCP Maximum Retransmission Timeout : 64000
TCP Maximum Simultaneous Connections : 4294967295
TCP Number of Active Opens : 12
TCP Number of Passive Opens : 0
TCP Number of Failed Connection Attempts : 0
TCP Number of Connection Reset : 0
TCP Number of current Connections : 0
TCP Number of Segments received : 528
TCP Number of Segments sent : 616
TCP Number of Segments retransmitted : 1
TCP Number of Segments received in error : 0
TCP Number of Segments sent with RST Flag : 0
TCP Connection Table
  Local-IP-Address  Local-Port  Remote-IP-Address  Remote-Port  State
=====
UDP Datagrams delivered to Users : 25223735
UDP Datagrams received for unknown Ports : 0
UDP Datagrams received with other Errors : 0
UDP Datagrams sent from this Entity : 25085481
UDP Listener Table
  Local IP Address : 0.0.0.0  Local Port : 1089
  Local IP Address : 0.0.0.0  Local Port : 29877
  Local IP Address : 192.16.0.152  Local Port : 1280
  Local IP Address : 0.0.0.0  Local Port : 1091
  Local IP Address : 192.16.0.152  Local Port : 1024
  Local IP Address : 192.16.0.152  Local Port : 1536
  Local IP Address : 0.0.0.0  Local Port : 1095
  Local IP Address : 192.16.0.152  Local Port : 1792
  Local IP Address : 0.0.0.0  Local Port : 29879
=====
ICMP Messages received : 1
ICMP Messages with Format Error : 0
ICMP Destination Unreachable Messages received : 1
ICMP Time Exceeded Messages received : 0
ICMP Parameter Problem Messages received : 0
ICMP Source Quench Messages received : 0
ICMP Redirect Messages received : 0
ICMP Echo Messages received : 0
ICMP Echo Reply Messages received : 0
ICMP Timestamp Messages received : 0
ICMP Timestamp Reply Messages received : 0
ICMP Address Mask Request Messages received : 0
ICMP Address Mask Reply Messages received : 0
ICMP Messages this Entity sent : 0
ICMP Messages not sent due to ICMP Problems : 0
ICMP Destination Unreachable Message sent : 0
ICMP Time Exceeded Messages sent : 0
ICMP Parameter Problem Messages sent : 0
    
```

Figure 44. CI860 MIB II Statistics

HSE Stack

In **HSE Stack** the statistics of the HSE communication running on CI860 is summarized. The HSE page provides same information as described in the chapter [CI860 Statistic Channel](#) on page 88, and also provides information such as CPU Load, FF Load, Stall Count Expired, Stall Count Warning Low, Stall Count Warning High.

Stall Count Expired indicates the status of cyclic communication. If the value is set to zero, the cyclic communication is running as scheduled and signals are not missing. The count increases, when there is an unused, unsupplied, or stalled signal, as shown in [Figure 46](#). The increase in the count is visible on subsequent pressing of HSE Stack menu and depends on the number of suspect signals, the macro cycle time and the frequency of pressing the HSE Stack menu.

The behavior of **Stalled Signals** is similar to the **Stall Count Expired**. The stalled signal displays a list of **Dump of stalled signals since last printout** (see [Figure 46](#)). The list indicates the missing or unsupplied signals in the FF device area. This occurs when the signals or H1 devices are physically not available. The stalled signals are empty (see [Figure 45](#)) under normal conditions. The HSE Stack menu must be pressed twice to get an updated stalled signal list.

The screenshot shows a web browser window with the URL `http://172.16.0.15/index.htm`. The page title is "Service Diagnosis for CI Modules" and the version is "Vers. 02.04-11". The ABB logo is visible in the top left. A notification at the top states "The web server will be disabled in 3 hours and 48 minutes".

The main content area is titled "HSE Stack Info" and displays a list of statistics for "Slot 1 CI860". The statistics are as follows:

Publish Counter	: 24960342
Subscribe Counter	: 24974377
Connection failed	: 0
Stall Count Expired	: 0
Stall Count Warning Low	: 40
Stall Count Warning High	: 0
CPU Load	: 50
FF Load	: 62
Skipped Datagrams	: 0
Out of Memory	: 0
Overruns	: 0
FFIO LoadPeaks	: 62
FFIO Wdog expired	: 0
Data consist. fail	: 20
Data consist. abort	: 0
Pub limiter active	: 529
Received datalen mismatch	: 0
ClT/srv requests	: 489
ClT/srv read requests	: 59
ClT/srv write requests	: 0
ClT/srv read failures	: 0
ClT/srv write failures	: 0
ClT/srv connect requests	: 196
ClT/srv connect failures	: 6
ClT/srv connection aborts	: 0
ClT/srv dropped invoke IDs	: 1
ClT/srv open connections	: 0
ClT/srv invalid names used	: 0
ClT/srv cycl write to static	: 0
ClT/srv session closed by HSE stack	: 0
ClT/srv Watchdog expire warnings	: 0

Below the statistics, there is a section for "Dump of stalled signals since last printout :".

Figure 45. CI860 HSE Stack

The screenshot shows a web browser window with the URL `http://172.16.0.15/index.htm`. The page title is "ABB The web server will be disabled in 3 hours and 48 minutes". The main content area is titled "HSE Stack Info" and displays the following data:

Slot 1 CI860	
Controller Status	Publish Counter : 25007082
Event History	Subscribe Counter : 25020343
Network Statistics	Connection failed : 0
pNA Statistics	Stall Count Expired : 651
MIB II Statistics	Stall Count Warning Low : 70
Task Info	Stall Count Warning High : 30
pSOS+ Kernel	CPU Load : 47
Boot Block	FF Load : 59
Transceiver Status	Skipped Datagrams : 0
HSE Stack	Out of Memory : 0
External Web	Overruns : 0
	FFIO LoadPeaks : 63
	FFIO Wdog expired : 0
	Data consist. fail : 20
	Data consist. abort : 0
	Pub limiter active : 532
	Received datalen mismatch : 0
	Clt/srv requests : 489
	Clt/srv read requests : 59
	Clt/srv write requests : 0
	Clt/srv read failures : 0
	Clt/srv write failures : 0
	Clt/srv connect requests : 196
	Clt/srv connect failures : 6
	Clt/srv connection aborts : 0
	Clt/srv dropped invoke IDs : 1
	Clt/srv open connections : 0
	Clt/srv invalid names used : 0
	Clt/srv cycl write to static : 0
	Clt/srv session closed by HSE stack : 0
	Clt/srv Watchdog expire warnings : 0

Dump of stalled signals since last printout :

```
Signal stalled with Fdaddress 100c1920 OdIndex 454
Signal stalled with Fdaddress 100c1b20 OdIndex 968
Signal stalled with Fdaddress 100c2320 OdIndex fa8
Signal stalled with Fdaddress 100c2120 OdIndex 580
Signal stalled with Fdaddress 100c2020 OdIndex 166
Signal stalled with Fdaddress 100cf20 OdIndex 171
Signal stalled with Fdaddress 100c1e20 OdIndex 134
Signal stalled with Fdaddress 100cd20 OdIndex 4b9
Signal stalled with Fdaddress 100c1c20 OdIndex 260
Signal stalled with Fdaddress 100c1a20 OdIndex 260
Signal stalled with Fdaddress 100d2220 OdIndex 198
Signal stalled with Fdaddress 100d2320 OdIndex fa8
Signal stalled with Fdaddress 100d2120 OdIndex 254
Signal stalled with Fdaddress 100d2020 OdIndex fa8
Signal stalled with Fdaddress 100dd20 OdIndex 134
```

Figure 46. CI860 HSE Stack - Stalled Signals

Table 28 explains the FdaAddress with stalled signals.

Table 28. Stalled Signals with FdaAddress

Item No.	Description
1 - 100a1b20 OdIndex 134	FdaAddress and OdIndex displayed in the HSE Stack info indicates the stalled signal of the HSE device.
2 - 100a	<p>The first four characters of the FdaAddress represent the H1-Link number of the HSE subnet.</p> <p>The H1-Link can be found in the Device List of the Hardware structure in FBB.</p> <p>The numbering starts with 1000. 1000 stands for Link0, 1001 to Link1, 1002 to Link2, etc. Each LD 800HSE contains four H1 - links. The information is in hexadecimal</p>
3 - 1b20	<p>The next two characters (1b) represents the Bus address of the device connected to the H1 link. The information is in hexadecimal.</p> <p>The last two characters (20) define the Signal ID. This is an internal ID of the configured signals for the device.</p> <p>The first configured signal gets ID 20, the next 21, then 22 and so on. If only one signal is configured in the device, then only entries with the value 20 are seen for the stalled signals.</p>
4 - OdIndex 134 (308)	The OdIndex no. (134) represents the signal by name and definition. On device level for each Block ID the corresponding starting value for the used OdIndexes are listed. To find the desired signal, the properties of the relevant Block ID with the correct start value must be opened.
5 -	In the Properties view, the value (8) in the relative column is displayed in the signal address.

Create Service File

To create a service file, click **Create service file**. The Web Interface automatically compiles all the required information into a service file, in case of a support action. The information in the service file is included only for the modules that have been selected.

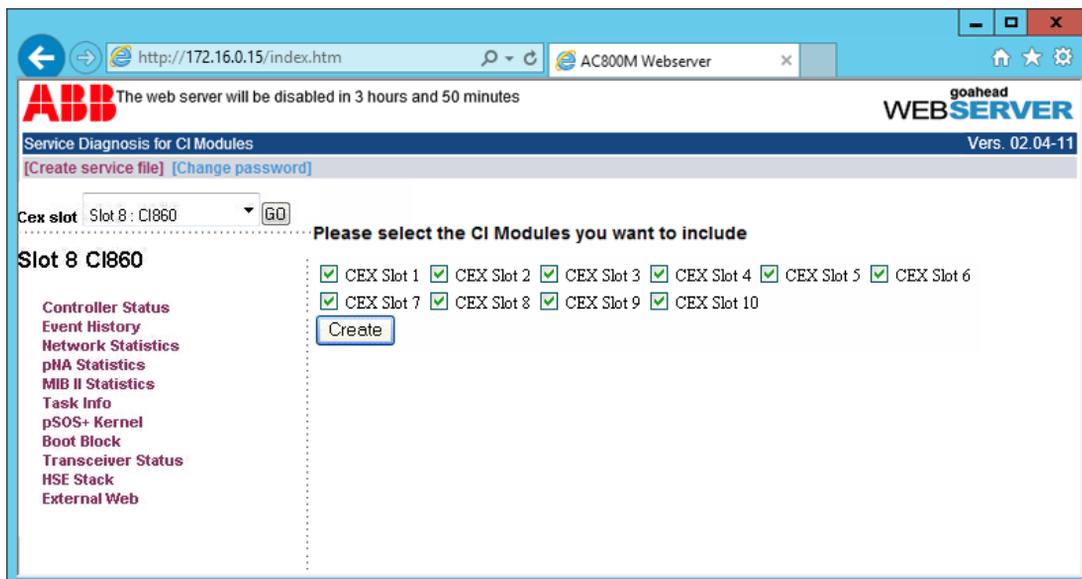


Figure 48. CI Module Selection for Service File

Click **Create**. A **File Download** window appears with the options to **Open** or **Save** the file to the hard disk.



If the user has cleared the check box **Always ask before opening this type of file** during the previous file download then the service file is opened in Notepad.

Change Password



The controller password should not be changed when several users are using the web server at the same time. If several web browser pages are connected to the web server, close all except for one before changing the password.

The **Change Password** page is used for changing the default password of the webserver. The web server page displays a caution to change the default password, when a user login for the first time as shown in the [Figure 49](#). The caution is displayed for every login, until the default password is changed to a new password.



After the controller password has been changed through web server page, a login window appears, you need to login again with the new password.

To change the password from default, select the **Change password** option available at the top left corner of the browser window. Enter the current and the new password and confirm the new password.

The screenshot shows a web browser window with the address bar displaying 'http://172.16.0.15/index.htm' and a tab titled 'AC800M Webserver'. The page content includes the ABB logo and a warning: 'The web server will be disabled in 3 hours and 55 minutes'. The main heading is 'Service Diagnosis for CI Modules' with a version number 'Vers. 02.04.11'. A navigation bar contains links for '[Create service file]' and '[Change password]'. The 'Change password' section features a 'GO' button, a 'Please select a CI device' dropdown menu, and a 'Current password:' field. Below this, a list of password requirements is provided:

- between 8 and 15 characters
- characters from at least three of the categories:
 - Digits (0-9)
 - Lower case (a-z)
 - Upper case (A-Z)
 - Special characters ({}~!@#\$%^&*+=|{}[];':"<>.,?/_)
- the password can also contain spaces

There are input fields for 'New password:' and 'Confirm new password:', both highlighted in green. At the bottom, there are 'Change Password' and 'Reset' buttons, and a red message 'Change password succeeded!'.

Figure 49. Change Password Dialog

A successful operation is confirmed with a message *Change password succeeded*. The new password is active immediately and stored nonvolatile in the AC 800M controller.

Reset Default Password

Use the IP Config Tool to reset the controller password to default password. Perform the following to reset the default password:



Ensure that the COM port of the PM8xx controller is connected to a COM port of the computer through a serial cable (If it is a PM86x controller, the port of the controller to be connected is the marked **COM4**). In the IP Config tool select the COM port of the computer that is connected to the controller.

1. Open **IP Config** window and select **Settings** menu.

From the **Com Port** context menu, select the corresponding Com port of the computer. In this example, **Com1** is selected as shown in [Figure 50](#). After selecting the COM port, click **Connect**

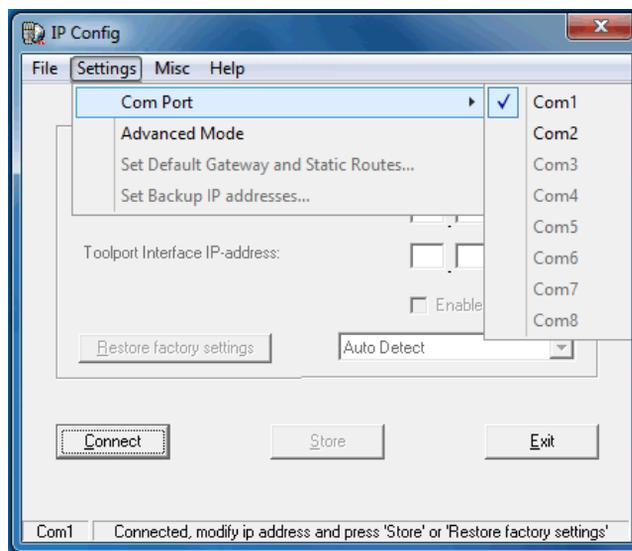


Figure 50. IP Config Tool - COM Port Settings



IP Config tool can be started only after a long reset of the controller. Later a fresh download is performed, as the configuration is erased during reset.

2. In the **Misc** menu, click **Reset Controller Password**.

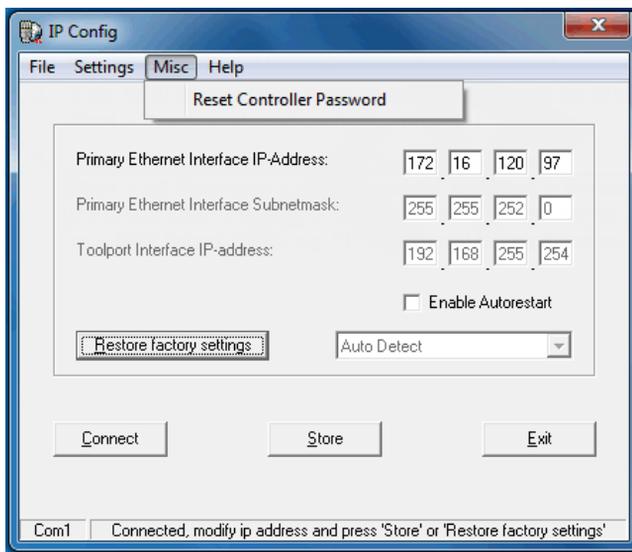


Figure 51. IP Config Tool - Reset Controller Password

3. A confirmation window, *The Controller password has been reset* appears.



Figure 52. Reset Password - Confirmation Window

Appendix A Application Example

This section provides two sample application configurations:

- A distributed cascaded PID control loop running on FOUNDATION Fieldbus network and on the AC 800M controller.
- An FF function block mode switch from an AC 800M controller application via CI860 Client/Server communication.

Prerequisites and Requirements

The following requirements must be met in order to be able to carry out the actions described in this section.

- An 800xA system has been created and started.
- The following system extensions have been added:
 - AC 800M Connect,
 - Device Management FF extensions.
 - Engineering Base
- The Plant Explorer Workplace has been started.
- The user has Configure and Download permissions.
- An HSE subnet configuration is available
- A Control Network has been created in the Plant Explorer Workplace and the FFHSECommLib has been added. The Control Network contains an AC 800M controller with at least one CI860 module. The CI860 Host object is inserted as child of the CI860 module.
- Configured hardware is available and connected.

Distributed Cascaded Control Loop

The sample Cascaded PID Control Loop features the following FF devices: an electro-pneumatic positioner, a pressure and a temperature transmitter. The electro-pneumatic positioner has two FF function blocks: A PID controller and an analog output function block (AO). From the pressure and the temperature transmitter the analog input function blocks (AI) are used.

The master PID control loop controls the temperature and is running in the AC 800M controller. The process signal is been provided by the temperature transmitter.

The slave PID control loop controls the pressure. The PID and the analog output function block is running in the positioner device. The setpoint for this slave PID is been provided by the master PID, the pressure signal by the pressure transmitter.

The master PID loop has to be configured with Control Builder whereas the slave PID including the AO and AI function blocks have to be configured with Fieldbus Builder FF.

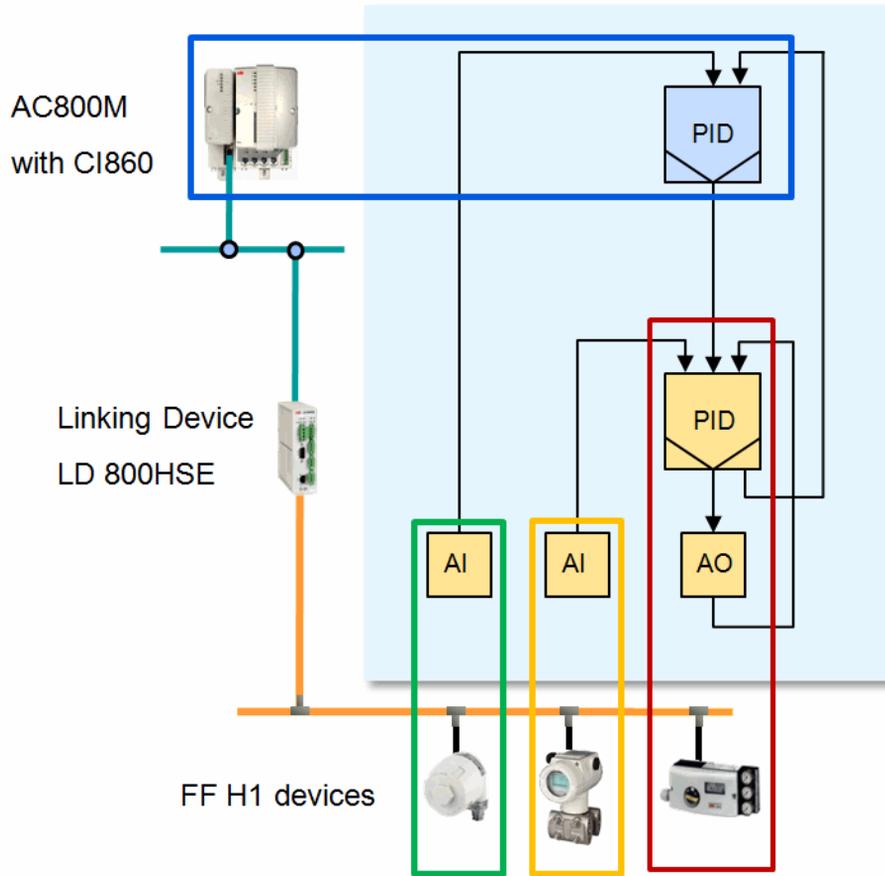


Figure 1. Sample Cascaded Control Loop Running Distributed on FF and on AC 800M Controller

FOUNDATION Fieldbus Configuration

The following section describes the FF configuration created with Fieldbus Builder FF. The focus here is at application part. For information concerning the hardware configuration, refer to *Device Management FOUNDATION Fieldbus, Configuration (3BDD012902*)* manual.

Pressure Control Loop running on the FF Field Devices

Figure 2 shows the FF Function Block Application Diagram for the slave PID control loop.

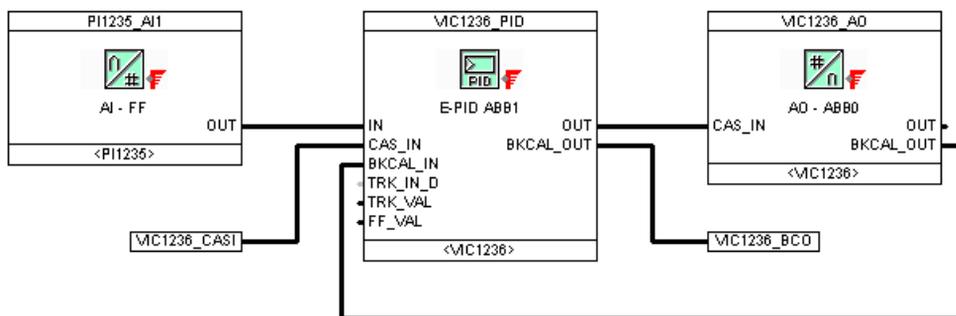


Figure 2. Fieldbus Builder FF - Cascaded PID Loop, Slave PID

On the left hand side the FF analog input (AI) function block is displayed, which is running on the pressure transmitter PI1235. It provides the pressure process value as input signal for the PID block running on the electro-pneumatic positioner VIC1236. The PID output is connected to the analog output (AO) function block running on the electro-pneumatic positioner as well. This AO function block provides a back-calculation signal that is connected to the BCAL_IN input of the FF PID function block. So this small control logic is running complete locally on the FF H1 Link.

At the PID function block two signals are necessary to be configured for communicating with the master PID control loop which is running on the AC 800M controller:

- the setpoint signal VIC1236_CASI connected at the CAS_IN input of the PID block
- and the back-calculation signal VIC1236_BCO connected at the OUT output of the PID block

Figure 3 shows exemplarily the signal Properties dialog which occurs during signal creation - in this case for the setpoint signal VIC1236_CASI.

This signal has to be transferred from AC 800M controller to the HSE subnet. So, in the reference list below of this dialog the signal has to be assigned to the CI860 by simply checkmark the appropriate checkbox. So the source for this signal is the CI860. The appropriate field in the column “Source” has to be set to “Yes”. The default is “No”. So, it is already correct adjusted for the second signal VIC1236_BCO, which is transferred from FF HSE to the controller via CI860 (an FF signal can only have one source).

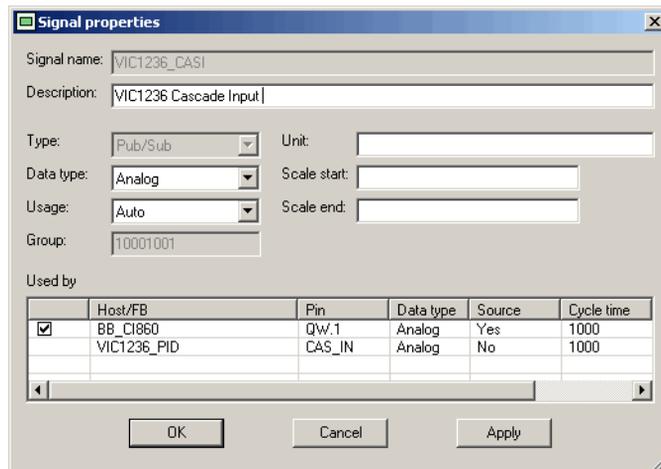


Figure 3. Fieldbus Builder FF - Signal Properties for Pub/Sub signal

Temperature process Signal for AC 800M Controller

The temperature control loop - the master PID control loop - running on the AC 800M controller needs to get the temperature process signal TI1234_T1. It is coming from the FF temperature transmitter.

Figure 4 shows the necessary FF application: A simple AI function block and the appropriate signal.

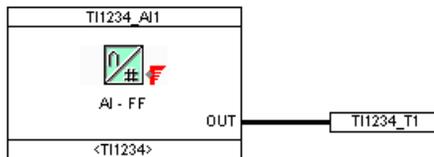


Figure 4. Fieldbus Builder FF I/O Application Diagram

The signal assignment to the CI860 can be done like above directly during the signal creation. It is also possible to perform this out of the Signal List (see Figure 5). Here multiple selected signals can be assigned to a CI860 in one step.

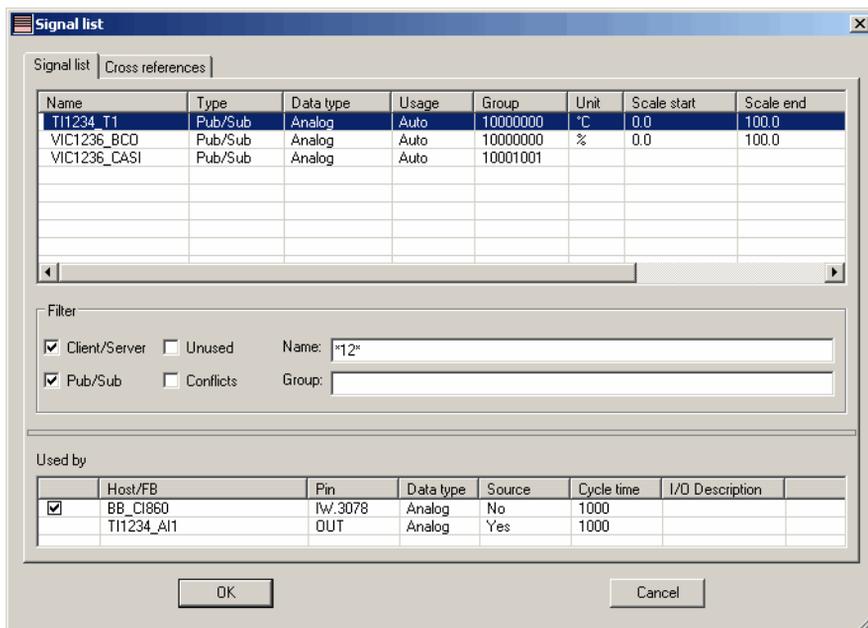


Figure 5. Fieldbus Builder FF - Signal List

Control Builder Application Configuration

Figure 6 shows the configuration of the master PID control loop is done with Function Designer for the AC 800M controller. Alternative this configuration can also be done in the Control Module Editor.

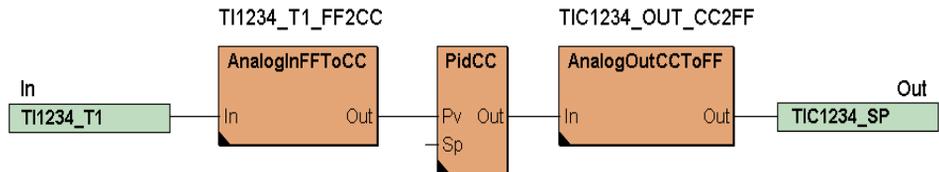


Figure 6. Function Designer - Cascaded PID Loop, Master PID

The analog FF input block provides a signal (TI1234_T1) that will be used as input signal in the temperature control loop (master PID control loop) running on an AC 800M controller. An AnalogInFFToCC control modules is used to convert the FF signal from the FFRealConnection type to the ControlConnection type. It is graphically connected to the PID control module input. The PID control module does the temperature control. An AnalogOutCCToFF control module is used to convert the output signal from the PID control module from the ControlConnection type to the FFRealConnection type. The output signal from the temperature control loop (TIC1234_SP) is used as a input signal for the FF PID function running in the H1 device (see Figure 2).

Control Builder CI860 Channel Mapping

Figure 7 shows the Control Builder variables being used. The variable TI1234_T1 is the input signal and the variable TIC1234_SP the output signal of the master PID control loop (see Figure 6). Both variables are of the data type FFRealConnection. Figure 8 shows how these variables are mapped to the CI860 channels.

	Name	Data Type	Attributes	Initial Value	I/O Address	Access Variables	Description
1	T11234_T1	FFRealConnection	retain				
2	TIC1234_SP	FFRealConnection	retain				
3							
4							
5							

Global Variables Variables

Row 1, Col 1 Installer

Figure 7. Variable Definitions

Channel	Name	Type	Variable	Protocol Info	I/O Description
QW2.0	FF Real Publish 0	ReallIO	Application_1.TIC1234_SP.Forward	VIC1236_CASI	
IW2.3073	FF Real Subscribe 1	ReallIO	Application_1.TIC1234_SP.Backward	VIC1236_BCO	
IW2.3074	FF Real Subscribe 2	ReallIO	Application_1.T11234_T1.Forward	T11234_T1	
IW2.6500	No of HSE publisher	DintIO		Extended status	
IW2.6501	No of HSE subscriber	DintIO		Extended status	
IW2.6502	CPU load	DintIO		Extended status	
IW2.6503	No of send failed	DintIO		Extended status	
IW2.6504	No of exp. stall count	DintIO		Extended status	
IW2.6505	Average FF load	DintIO		Extended status	
IW2.6506	UDP received w/o processing	DintIO		Extended status	
IW2.6507	Reserved 2	DintIO		Extended status	
IW2.6508	Reserved 3	DintIO		Extended status	
IW2.6509	No Clt/Srv requests	DintIO		Extended status	
IW2.6510	No Clt/Srv reads	DintIO		Extended status	
IW2.6511	No Clt/Srv writes	DintIO		Extended status	
IW2.6512	No Clt/Srv reads failed	DintIO		Extended status	
IW2.6513	No Clt/Srv writes failed	DintIO		Extended status	
IW2.6514	No Clt/Srv connects	DintIO		Extended status	
IW2.6515	No Clt/Srv connects failed	DintIO		Extended status	
IW2.6516	No Clt/Srv connection aborts	DintIO		Extended status	
IW2.6517	Reserved	DintIO		Extended status	

Settings Connections Status Unit Status

Row 1, Col 5 Installer

Figure 8. CI860 Connections Editor with Variable Mapping

As the FFRealConnection data type contains a forward and a backward component similar to the ControlConnection data type one of the components must be chosen according to the direction of the signal flow.

The FF temperature output signal TI1234_T1 of the temperature transmitter is available on the CI860 input channel IW2.3074. To access this signal the forward component of the Control Builder variable TI1234_T1 from data type FFRealConnection has to be mapped to this channel.

The back calculation signal VIC1236_BCO from the FF PID function block VIC1236_PID which is available on the input channel IW1.3073 is mapped to the backward component of the variable TIC1234_SP. The forward component of the variable TIC1234_SP is mapped to the CI860 output channel QW2.0 which is connected to the setpoint signal VIC1236_CASI.

Switching FF Function Block Mode

This sample describes how to switch the Target Mode parameter of the FF function block VIC1236_PID from the sample above out of a Control Builder application. To access the FF block contained parameter the Client/Server communication is used.

In Control Builder the Target Mode of the PID function block should be read cyclically and written on a request (a event which is triggered from a AC 800M application). For this the FF parameter is assigned to a Client/Server signal which can be accessed from the Control Builder application. The creation and the assignment of this Client/Server signal is done in Fieldbus Builder FF.

FOUNDATION Fieldbus Configuration

The assignment of a Client/Server Signal to a FF block parameter is done in the Properties dialog of the FOUNDATION Fieldbus block as shown in [Figure 9](#). The Client/Server signal VIC1236_TARGET is assigned to the function block parameter MODE_BLK.Target of the PID function block VIC1236_PID.

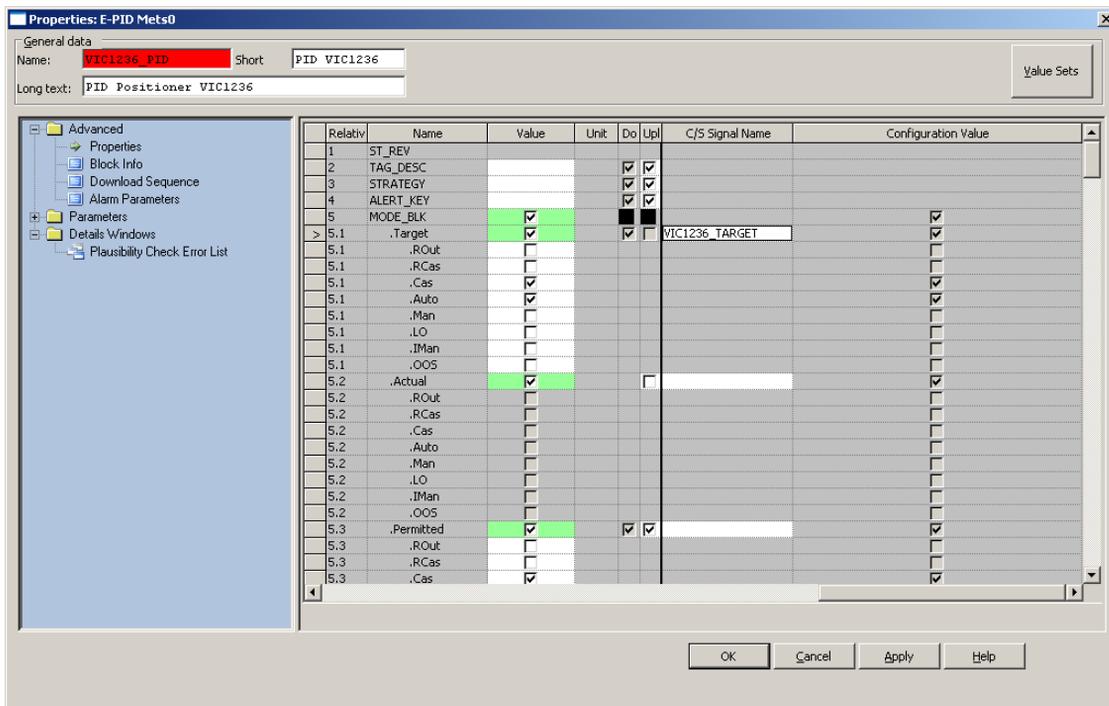


Figure 9. Fieldbus Builder FF Function Block Properties

To communicate the signal between AC 800M controller and HSE Subnet, the Client/Server signal has to be assigned to a CI860. The procedure for this assignment is for a Client/Server signal the same as for the Publisher/Subscriber signal in the sample above. Figure 10 shows exemplary the Signal Properties dialog which occurs during the creation of the signal VIC1236_TARGET. In the reference list below of this dialog the signal is assigned to the CI860 due the checkmark of the appropriated checkbox.

Signal name: VIC1236_TARGET

Description: VIC1236_PID Target Mode

Type: Client/Server Unit:

Data type: Generic Scale start:

Usage: Auto Scale end:

Group: 0

Used by

	Host/FB	Pin	Data type	Source	Cycle time	I/O Des
<input checked="" type="checkbox"/>	BB_CI860	C/S Connect	Generic	No		
<input type="checkbox"/>						
<input type="checkbox"/>						

OK Cancel Apply

Figure 10. Fieldbus Builder FF - Signal Properties for C/S signal

Alternatively the CI860 assignment can be done from the Fieldbus Builder FF Signal List which even provides the assignment of multiple selected signal to a CI860 (see Figure 5).

Control Builder Application Configuration

In the section above the Target Mode parameter of this FF function block was assigned to the Client/Server signal VIC1236_TARGET which can now be accessed from Control Builder. Figure 11 shows the Control Builder application for this activity realized with the Client/Server specific function blocks from the FFHSECommLib. In this example it is programmed in a Function Block Diagram. Figure 13 shows how the same program can be realized in a Structured Text sequence. Figure 12 gives an overview of the used variables for this application.

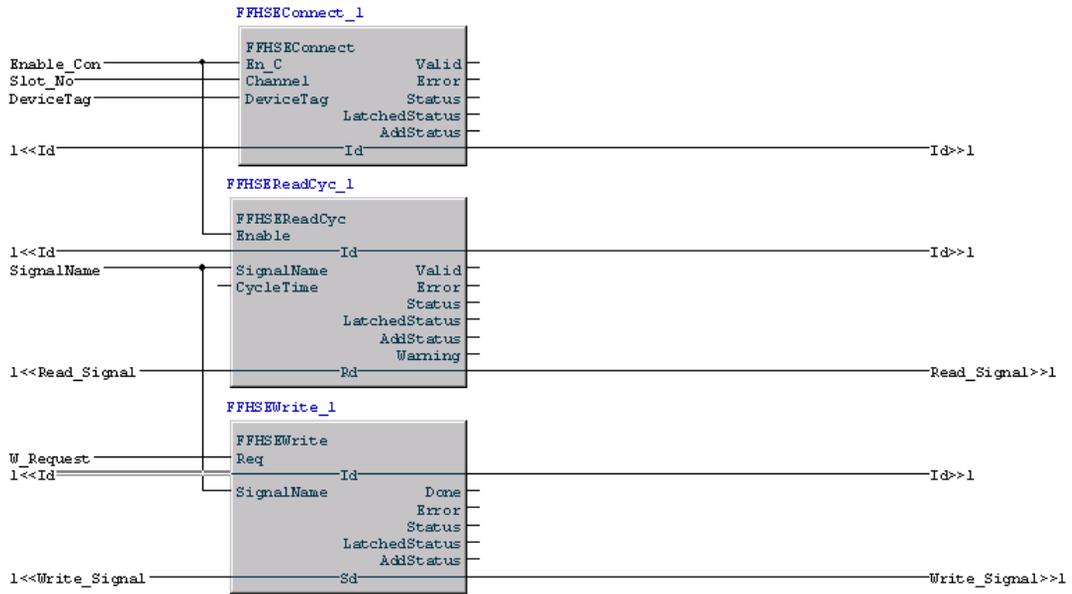


Figure 11. Control Builder Function Block Diagram for C/S access

Name	Data Type	Attributes	Initial Value	I/O Address	Access Variables	Description
1 Enable_Con	bool	retain	true			Enable connection
2 Slot_No	string[16]	retain	2'			CIB60 Module CEX number (slot number)
3 DeviceTag	string[32]		'VIC1236'			Device Tag of H1 device
4 Id	Comm_Channel					Communication ID
5 SignalName	string[32]		'VIC1236_TARGET'			Name of C/S signal
6 Read_Signal	FFBitStrLen8DS14	retain				'Writes C/S signal 'SignalName' to variable 'Read_Signal'
7 Write_Signal	FFBitStrLen8DS14	retain				'Writes variable 'Write_Signal' to C/S signal 'SignalName'
8 W_Request	bool					'Write signal on request'

Figure 12. Control Builder Variables used for C/S access

```

(* Connect to Devicetag *)
FFHSEConnect_1( En_C := Enable_Con,
                Channel := Slot_No,
                DeviceTag := DeviceTag,
                Id := Id );

(* Read SignalName cyclically *)
FFHSEReadCyc_1( Id := Id,
               Enable := Enable_Con,
               SignalName := SignalName,
               Rd := Read_Signal );
GetBlockMode := Read_Signal.Value;

(* Write SignalName on request *)
Write_signal.Value := SetBlockMode;
FFHSEWrite_1( Id := Id,
              Req := W_Request,
              SignalName := SignalName,
              Sd := Write_Signal );

```

Figure 13. Control Builder Structured Text sequence for C/S access

Table 1 provides the Integer values of the FOUNDATION Fieldbus block modes as they are read and written from the Client/Server specific function blocks (in this example only the Target Mode parameter is used).

Table 1. Integer values of FF function block modes used by C/S function blocks

Mode	Target	Actual
Remote Output	144	128
Remote Cascade	80	64
Cascade	48	32
Automatic	16	16
Manual	8	8
Local Override	-	4
Initialization Manual	-	2
Out of Service	1	1

FFHSEConnect Configuration

To read and write the FF parameter, a connection to the H1 device VIC1236 (the electro-pneumatic positioner) needs to be established. This is done via the FFHSEConnect function block. It needs informations about which CI860 (exactly which bus slot number) the connection should be established. The bus slot number is provided via the input parameter Channel which is connected to the variable Slot_No with the Initial value of 2. This means that the CI860 is placed at the CEX bus slot number two. Further the FFHSEConnect function block needs to know to which H1 device the connection goes. Therefore the variable DeviceTag is connected to the input parameter of the same name. It provides the device tag name VIC1236 which was defined in Fieldbus Builder FF. To enable the execution of the function block the input parameter En_C is getting a true value from the variable Enable_Con. If the connection is established the FFHSEConnect parameter Id provides the Communication Id which is needed from the Read/Write function blocks. The value of this Id parameter is stored in the variable Id. [Figure 14](#) shows the Parameter Dialog of the FFHSEConnect function block.

Name	Data Type	Initial Value	Parameter	Attributes	Direction	Description
1 En_C	bool		Enable_Con	retain	in	Enables the execution while True
2 Channel	string[16]		Slot_No	by_ref	in	The CEX bus slot number to be used for the connection
3 DeviceTag	string[32]		DeviceTagConn1	by_ref	in	The tag name of the FF device as it is defined in FBB FF
4 Valid	bool				out	True when the output values are valid
5 Error	bool			retain	out	Indicates an error with True during one scan. Status parameter < 0
6 Status	dint	1		retain	out	Status code of last execution, operation successful 1, pending 0, errors < 0, warnings > 1
7 LatchedStatus	dint			retain	out	The last non good status value is saved in here
8 AddStatus	dint			retain	out	Additional status information coming from FF in case of failure
9 Id	Comm_Channel		Id		in_out	OUT (IN) Communication channel, has to be connected to a FB of the type Read/Write

Figure 14. FFHSEConnect Parameter Dialog in Sample Application

FFHSEReadCyc Configuration

To read the target block mode cyclically, the FFHSEReadCyc function block is used. The input parameter SignalName is connected to the same named variable which provides the information which Client/Server signal should be read - in this case the signal VIC1236_TARGET. The value of the signal is given to the parameter Rd which is connected to the variable Read_Signal.

The Target parameter `MODE_BLK.Target` from the FF PID function block is from the Fieldbus Builder FF type Bit Enumerated (1 octet), so the Control Builder variable `Read_Signal` has to be from the data type `FFBitStrLen8DS14` (see [Table 21](#)). In the Structured Text sequence in [Figure 13](#) the value of the variable `Read_Signal` is given to the variable `GetBlockMode` which can now be used in other Control Builder applications.

The `Id` parameter must be connected to the variable `Id` which provides the Communication `Id` from the `FFHSEConnect` function block. For an execution of this parameter the input parameter `Enable` needs a true value which is given by the variable `Enable_Con`. The time interval how often the Client/Server signal should be read is given by the parameter `CycleTime`. The value therefore is in this case 5 seconds and directly configured in the Parameter Dialog of the `FFHSEReadCyc` function block (see [Figure 15](#)). If another value for the `CycleTime` is needed, this parameter can be connected to a variable which provides this value.

Name	Data Type	Initial Value	Parameter	Attributes	Direction	Description
1 Enable	bool		Enable_Con	retain	in	Enables the execution while True
2 Id	Comm_Channel		Id		in_out	IN (OUT) Communication channel, has to be connected to the Id- par. of the Connect- FB
3 SignalName	string[32]		SignalName		by_ref	The name of the FF client/server signal as it is defined in FBB FF, read after first invocation
4 CycleTime	time	TIME#5s			in	Time interval between consecutive operations
5 Valid	bool			retain	out	True when the output values are valid
6 Error	bool			retain	out	Indicates an error with True. Status parameter < 0
7 Status	dint	1		retain	out	Status code of last execution, operation successful 1, pending 0, errors < 0, warnings > 1
8 LatchedStatus	dint			retain	out	The last non good status value is saved in here
9 AddStatus	dint			retain	out	Additional status information coming from FF in case of failure
10 Warning	bool			retain	out	True at a warning of unexpected operation. Status parameter > 1
11 Rd	AnyType		Read_Signal		in_out	OUT Read value of the variable "SignalName"

Figure 15. FFHSEReadCyc Parameter Dialog in Sample Application

FFHSEWrite Configuration

To write the target block mode on request, the `FFHSEWrite` function block is used. This function block writes the FF parameter given to the input parameter `SignalName`. In this case, the Client/Server signal `VIC1236_TARGET` is given by the variable `SignalName`. The value that should be written is given by the parameter `Sd` which is connected to the variable `Write_Signal`. The `Sd` parameter accesses the same FF block parameter (`MODE_BLK.Target`) as the `Rd` parameter from the `FFHSEReadCyc`, so the variable `Write_Signal` is also from the data type

FFBitStrLen8DS14 (see [Table 21](#)). In the Structured Text sequence in [Figure 13](#) the value of the variable Write_Signal is provided by the to the variable SetBlockMode which is used in other Control Builder applications.

The Client/Server signal is only written when the parameter Req gets a positive edge - in this case when the connected variable W_Request changes it value from zero to one. As for the FFHSEReadCyc function block the Id parameter must be connected to the variable Id which is provided by the Communication Id from the FFHSEConnect function block. [Figure 16](#) shows the Parameter Dialog of the FFHSEConnect function block.

Name	Data Type	Initial Value	Parameter	Attributes	Direction	Description
1 Req	bool		W_Request	retain	in	Requests one operation on positive edge, True
2 Id	Comm_Channel		Id		in_out	IN (OUT) Communication channel, has to be connected to the Id- par. of the Connect- FB
3 SignalName	string[32]		SignalName	by_ref	in	The name of the FF client/server signal as it is defined in FBB.FF, read after first invocation
4 Done	bool			retain	out	True when requested operation is done successfully
5 Error	bool			retain	out	Indicates an error with True. Status parameter < 0
6 Status	dint	1		retain	out	Status code of last execution, operation successful 1, pending 0, errors < 0, warnings > 1
7 LatchedStatus	dint			retain	out	The last non good status value is saved in here
8 AddStatus	dint			retain	out	Additional status information coming from FF in case of failure
9 Sd	AnyType		Write_Signal		in_out	IN Write value to be transferred to the variable "SignalName"

Figure 16. FFHSEWrite Parameter Dialog in Sample Application

Appendix B CI860 Error Codes

The error codes in [Table 2](#) and [Table 3](#) may appear as values at the Status parameter from the five FFHSE Client/Server function blocks:

The error codes in the following table are coming from PhCI860 (Protocol handler CI860) controller:

Table 2. Error Codes from PhCI860 in the controller

Error Code	Description
-7001	an internal error has occurred
-7002	the maximum number of connections is reached
-7003	too many requests at a time
-7004	communication to CI860 module doesn't work
-7007	the type of data to be written is not supported
-7008	the length of data to write does not fit, data type OK?
-7009	the data read does not fit to the connected variable, data type OK?
-7010	Ph says used connection is not established
-7011	Ph receives a illegal response from CI860 module
-7012	no relevance
-7013	request handling was aborted by Ph, e.g. redundancy switch of CI860 module

The error codes in the following table are coming from CI860 module firmware:

Table 3. Error Codes from CI860 firmware

Error Code	Description
-7051	internal error on servicing the request
-7052	request aborted because of disconnecting while servicing
-7054	the length of data received or data to write is not valid
-7055	usage of cyclic write FB for access to a static parameter
-7056	too many requests at a time
-7057	device tag or signal name not found
-7058	device not found, e.g. device not online
-7059	connection to device aborted
-7060	connect temporarily not possible, e.g. due to old connection not having timed out yet
-7061	device signals parameter to read does not exist
-7062	device signals parameter to write does not exist
-7063	the request timed out
-7064	the signal is requested via a different connection than configured
-7065	the requested object does not exist in the FF device
-7066	FF error class is set, check vendor specific error information
-7067	processing configuration data currently running, cannot proceed
-7068	no FF configuration data has been loaded to CI860
-7069	updating configuration data has aborted a request
-7070	an unexpected FF error code has been received, put original code into component AddCode
-7071	the access to the referenced object is denied

Table 3. Error Codes from CI860 firmware (Continued)

Error Code	Description
-7072	the address information in the request is invalid
-7073	there is a type conflict on accessing the data
-7074	a value to write is out of its FF range
-7075	configuration data loaded to CI860 is not consistent to FF subsystem

Revision History

This section provides information on the revision history of this User Manual.



The revision index of this User Manual is not related to the 800xA 5.1 System Revision.

The following table lists the revision history of this User Manual.

Revision Index	Description	Date
-	Published for 800xA 6.0	July 2014
A	Published for 800xA 6.0.3	September 2016



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