invensys
Foxboro®

I/A Series® System

Intrinsically Safe I/O Subsystem User's Guide

B0700DP

Rev C
September 20, 2010

Contents

Figures

Tables

Preface

This document describes how to configure and install the hardware associated with the Intrinsically Safe I/O Subsystem, including the Intrinsically Safe Communications Module (ISCM) which allows selected Pepperl+Fuchs™ intrinsically safe I/O modules (LB-style and FB-style versions) to communicate with a Control Processor in an I/A Series® system. It also describes how to troubleshoot system problems.

Who This Book Is For

This book is intended for the use of process control engineers and operators, instrument and maintenance engineers, and other qualified and authorized personnel involved in installing, configuring and maintaining the Intrinsically Safe I/O Subsystem, including the ISCM, Pepperl+Fuchs' I/O modules and associated base, redundancy and extension units.

What You Should Know

Prior to using this book, you should be generally familiar with the I/A Series system, and with *DIN Rail Mounted FBM Subsystem User's Guide* (B0400FA). Detailed information relating to the various I/A Series software and hardware elements associated with this product and sub-systems is found in the reference documents listed below.

Revision Information

For Revision C of this document, the following changes were made:

Chapter 1 "Introduction"

- Added new Ex-e connector to Figure 1-4 "Front Connector Types for Supported P+F Intrinsically Safe I/O Modules (Zones 1 and 2)" on page 9 and to a note in "Supported P+F Intrinsically Safe I/O Modules and Front Connectors Specifications for Zone 1 Environments" on page 11.
- Added I/O modules FB 1301 B, FB 1303 F, FB 1303 FL, FB 1304 F, FB 1304 FL, FB 1308 B, FB 3302 B, FB 3305 B, FB 4302 C, FB 4305 B, FB 6306 B, and FB 6308 B to Table 1-6 "Supported P+F Intrinsically Safe I/O Modules (Zone 1)" on page 11.
- Added Figure 1-7 "LB-Style and FB-Style ISCM to FCP270 I/O Communications via FCM2Fs (Simplified)" on page 18, Figure 1-8 "Fieldbus Cable Length Restrictions for FCP270, FCM100E and LB-Style Intrinsically Safe Units" on page 20, Figure 1-9 "Fieldbus Cable Length Restrictions for FCP270, FCM100E and FB-Style Intrinsically Safe Units" on page 20, and Figure 1-11 "Fieldbus Cable Length Restrictions for FCP270, FEM100 and Intrinsically Safe Units with FCM2Fs" on page 23.
- Added "Line Fault Detection and Bad I/O Alarming" on page 25.
- Added Figure 1-12 "NAMUR Replacement Resistors" on page 26.

- Removed the note about the 45 second wait time from "ISCM Redundancy" on page 28.

Chapter 3 "Installing the ISCM, P+F I/O Modules and Base/Extension Units"

- Added note about using Invensys® power supplies to provide power to P+F power supplies in "Installation and Cabling for Intrinsically Safe I/O Subsystems" on page 34.
- Updated note under "Zone 1 (FB-Style) Equipment Installation" on page 35.

Chapter 4 "Configuration Information"

- Added I/O modules FB 1301 B, FB 1303 F, FB 1303 FL, FB 1304 F, FB 1304 FL, and FB 1308 B to Table 4-5 "I/A Series Blocks for Supported Zone 1 IS/IO Modules" on page 81.
- Added I/O modules FB 3302 B, FB 3305 B, FB 4302 C, and FB 4305 B to Table 4-6 "I/A Series Blocks for Supported Zone 1 HART IS/IO Modules" on page 84.

Chapter 6 "Troubleshooting"

- Updated the warning in "Replacing a Failed ISCM or I/O Module" on page 127.
- Added "Replacing a Defective HDLC Cable" on page 128.

Appendix B "Module I/O Connections"

- Added FB 1303 F, FB 1303 FL, FB 1304 F, and FB 1304 FL to appendix.

Reference Documents

The following documents provide additional and related information.

For information about defining control blocks and compounds, refer to:

- *Integrated Control Block Descriptions* (B0193AX)
- *Integrated Control Software Concepts* (B0700AG)
- *System Definition: A Step-By-Step Procedure* (B0193WQ)

For information about configuring the ISCM in the I/A Series system, refer to:

- *Integrated Control Configurator* (B0193AV)

For information about configuring the ISCM in the InFusion™ system, refer to:

- *InFusion Block Configurator, Control Edition* (B0750AH)
- *InFusion Deployment Guide, Control Edition* (B0750BA)
- *InFusion Hardware Configuration, Control Edition* (B0750BB)

For information about system management for the ISCM and its I/O modules, refer to:

- *System Manager* (B0750AP)
- *InFusion View User's Guide, Control Edition* (B0750AQ)
- *System Management Displays* (B0193JC)
- *Process Operations and Displays* (B0700BN)
- *V8.x System Error Messages* (B0700AF)

For information on configuring and managing the ISCM's associated control processor (FCP270 or ZCP270), refer to:

- *Field Control Processor 270 (FCP270) User's Guide* (B0700AR)
- *Field Control Processor 270 (FCP270) Sizing Guidelines and Excel Workbook* (B0700AV)
- *Z-Module Control Processor 270 (ZCP270) User's Guide* (B0700AN)
- *Z-Module Control Processor 270 (ZCP270) Sizing Guidelines and Excel Workbook* (B0700AW)

For information about support hardware for the FCP270 or ZCP270, refer to:

- *DIN Rail Mounted FBM Subsystem User's Guide* (B0400FA)
- *FEM100 Fieldbus Expansion Module* (PSS 21H-2Y16 B4)
- *Fieldbus Communications Module, FCM2F2/FCM2F4/FCM2F10* (PSS 21H-2Y3 B3)

For specifications for the ISCM and the Pepperl+Fuchs intrinsically safe I/O modules, refer to:

- *Intrinsically Safe I/O Subsystem* (PSS 21H-2Y6 B4)

Most of these documents are available on the I/A Series Electronic Documentation CD-ROM (K0173TQ or K0173WT). The latest revisions of each document are also available through our IOM Global Customer Support Center at *http://support.ips.invensys.com.*

P+F Intrinsically Safe I/O Modules Overview Specifications

For information about the Pepperl+Fuchs' intrinsically safe I/O modules (LB and FB) supported by the ISCM, refer to:

- *FB Remote I/O Bus System Hardware* (Revision B of this document is titled *Operating Instructions for FB Remote I/O Housings Model FB92xx, FB9224, FB 9225, FB9248, FB9249 Base Unit, Extension Unit, Redundancy Unit*)
- *LB Remote I/O Bus System Hardware*

These documents may be in one of the following locations on the Pepperl+Fuchs website.

1. Refer to this Pepperl+Fuchs page:
   http://www.pepperl-fuchs.com/cps/rde/xchg/SID-266868B6-00F429C6/global/hs.xsl/index.htm

   From this page, find the Product Group "**Remote I/O Systems**". As of April 2010, this is found by clicking "**Products** "on the home page, then "**Go To: Process Automation**" and then "**Remote I/O Systems**", and then drilling down to the appropriate product:

   - For *FB Remote I/O Bus System Hardware*, under "**Products Process Automation**", click "**FB Zone 1**", then "**Enclosures**", then "**View All Products**", and then click the names of any of the field units (such as "**Field unit FB 9248** *"). Under "**Product Information**", click "**Technical Documents**" and a link to this document will appear. As of April 2010, this link is listed as "**Handbook FB-Remote I/O Bus-System Hardware**".
   - For *LB Remote I/O Bus System Hardware*, under "**Products Process Automation**", click "LB Zone 2", then "Accessories", then "**View All Products**", and then click the names of any of the base/extension units (such as "**Base backplane LB 9022 A**"). Under "**Product Information**", click "**Technical Documents**" and a link to

this document will appear. As of April 2010, this link is listed as "**LB Hardware Manual**".

-OR-

2. Refer to this Pepperl+Fuchs page:
   http://www.am.pepperl-fuchs.com/

   From this page, click "**Process Automation Start Here**", then under "**Products**", click "**Remote I/O**". Then drill down to the appropriate product:

   - For *FB Remote I/O Bus System Hardware*, under "**More Product info**", click "**FB Zone 1**", then "**Backplanes FB Zone 1**", and then click the names of any of the field units (such as "**FB 9248**"). A link to this document will appear under "**Manuals**". As of April 2010, this link is listed as "**FB System Operating Instructions**".
   - For *LB Remote I/O Bus System Hardware*, under "**More Product info**", click "**LB Div 2**", then "**Backplanes LB Div 2**", and then click the names of any of the field units (such as "**LB 9022**"). A link to this document will appear under "**Manuals**". As of April 2010, this link is listed as "**LB Hardware Manual**".

Additional product information for the I/O modules is available at the IPS Portal (*http://www.ips.invensys.pepperl-fuchs.com*).

P+F Intrinsically Safe Power Supply Specifications

For information about the Pepperl+Fuchs' power supplies used with the intrinsically safe I/O modules (LB and FB) supported by the ISCM, refer to the following data sheets:

- *LB 9006 24 V DC Power Supply*
- *FB 9206 24 V DC Power Supply Data Sheet*
- *FB 9204 - FB 9216 Power Supply Data Sheet*

These documents may be in the following location on the Pepperl+Fuchs website.

Refer to this Pepperl+Fuchs page: *http://www.am.pepperl-fuchs.com/*

From this page, click "**Process Automation Start Here**", then under "**Products**", click "**Remote I/O**". Then drill down to the appropriate product:

- For the FB-style power supplies, under "**More Product info**", click "**FB Zone 1**", then "**Power Supplies FB Zone 1**". Then click the names of the appropriate power supply (such as "**FB 9206**"). A link to this document will appear under "**Data Sheets**".
- For the LB-style power supplies, under "**More Product info**", click "**LB Div 2**", then "**Power Supplies LB Div 2**". Then click the name of the power supply (that is, "**LB 9006**"). A link to this document will appear under "**Data Sheets**".

Glossary of Terms

The following terminology, used throughout this user's guide, relates to the ISCM and associated equipment.

Name	Meaning
AI	Analog input

Name	Meaning
AO	Analog output
BPC	Block Processing Cycle
Checkpoint	Saving the Control Database to a file on the host workstation or Flash memory on the FCP270 or ZCP270.
DI	Digital input
DIN	DIN is a non-governmental organization established to promote the development of standardization and related activities in Germany.
DO	Digital output
DPIDA	Distributed PIDA controller that runs in the FBM
ECB	Equipment Control Block
EEPROM	Electrically erasable programmable read-only memory
EVENT	Control block used for SOE with ECB6
FB-Style	"Field Bus" style of P+F intrinsically safe I/O modules and their associated base/extension units and enclosures for Zone 1 environments
FBM	I/A Series system Fieldbus Module
FCM	Fieldbus Communication Module
FCP270	Field Control Processor 270
FDSI	Foreign Device Systems Integrator
FDT	Field Device Tool
HART	Highway Addressable Remote Transducer. HART® Field Communications Protocol is a standard for digitally enhanced 4 to 20 mA smart instrument communication.
HDLC	High-level Data Link Control protocol - Master/Slave Protocol used on top of several physical layers for FBM communication
I/A Series®	Intelligent Automation Series
ICC	Integrated Control Configurator - a configurator application
IEE	InFusion Engineering Environment
IFDC	Integrated Field Device Configurator
ISCM	Intrinsically Safe Communication Module
LB-Style	"Local Bus" style of P+F intrinsically safe I/O modules and their associated base/extension units and enclosures for Zone 2, Zone 21 or Zone 22 environments
LED	Light-emitting diode
Letterbug	Six -character alphanumeric string that the user defines to identify a station or module in The MESH control network or in an I/A Series, or Infusion control system.
MDACT	Motor Driven Actuator that runs in the FBM
PACTware	Process Automation Configuration Tool. Fieldbus-independent software for operating field instruments distributed by the PACTware Consortium
ROM	Read only memory

Name	Meaning
SMDH	System Management Display Handler, the user interface for equipment status and change actions
SOE	Sequence of Events
SysDEF	System Definition
System or Control Configurator	Software for configuring your system, such as ICC or IEE.
TDR	Transient Data Recorder
The MESH	The MESH Control Network
ZCP270	Z-Module Control Processor 270

1. Introduction

This chapter describes the main features, operation, and network configuration for the Intrinsically Safe I/O Subsystem hardware, including the Intrinsically Safe Communications Module (ISCM), Pepperl+Fuch's I/O modules and associated base/extension units.

Overview

The Intrinsically Safe I/O Subsystem uses the Intrinsically Safe Communications Module (ISCM) to provide integration between the Pepperl+Fuchs (P+F) modular intrinsically safe remote I/O systems and the I/A Series system. The ISCM enables I/A Series control processors to view the intrinsically safe I/O modules as equivalent 200 Series Fieldbus Modules (FBMs) over the I/A Series 2 Mbps HDLC Fieldbus. This allows the I/O modules to be monitored with standard I/A Series blocks and standard I/A Series or InFusion system/control configurator applications such as the InFusion Engineering Environment or I/A Series ICC.

NOTE

The IACC and FoxCAE configurator applications do not support the Intrinsically Safe I/O Subsystem.

Optionally redundant ISCMs can be installed in an ISCM base or extension unit which can be mounted on a DIN rail along with I/O modules as shown in Figure 1-1 and Figure 1-2. Different versions of P+F base/extension units and I/O modules may be installed in potentially explosive atmospheres in Zone 1/Zone 21, or Zone 2/Zone 22 environments. Each I/O module can be plugged into any desired slot on the base/extension unit. ISCMs are required to be plugged into their own dedicated slots.

Two versions of the ISCM are available for installation in Zone 1 or Zone 2 environments (listed in Table 1-2). Depending on the sizing guidelines, a single or redundant pair of ISCMs for Zone 2 applications support up to 46 intrinsically safe LB-style I/O modules, while a single or redundant pair of ISCMs for Zone 1 applications supports up to 48 intrinsically safe FB-style I/O modules.

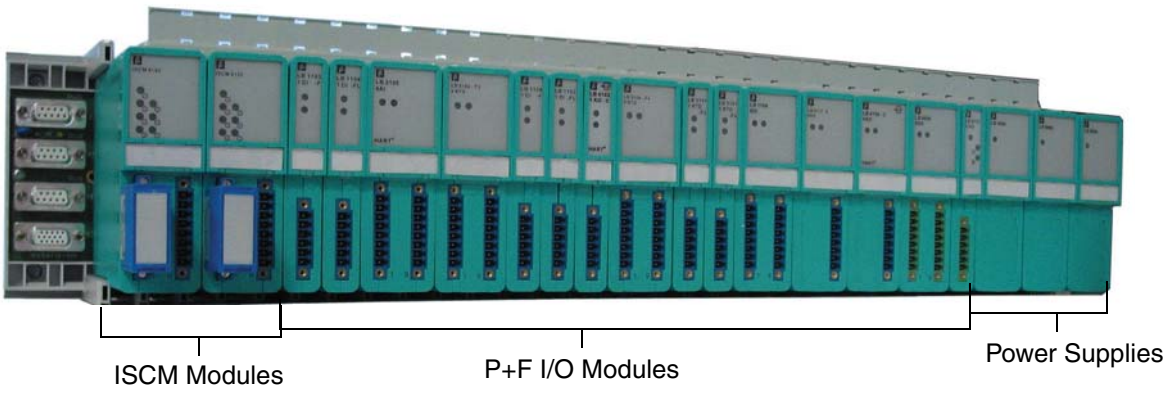


Figure 1-1. ISCM in Base Unit for LB (Zone 2) Applications

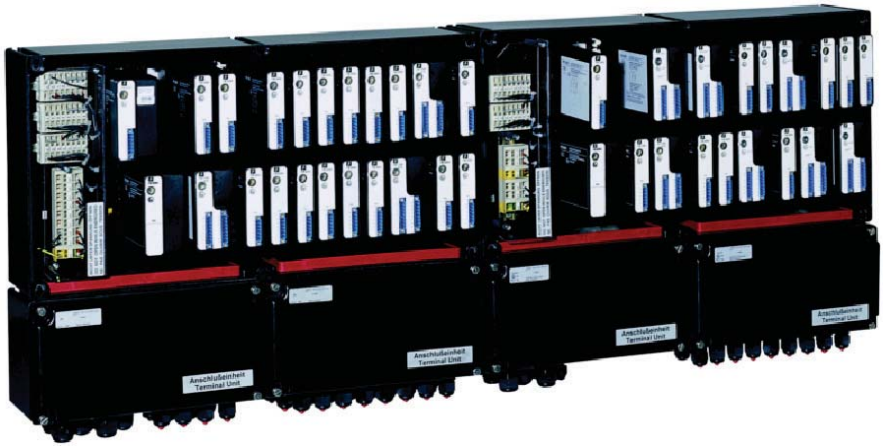


Figure 1-2. Base and Extension Units for FB-Style (Zone 1) Applications

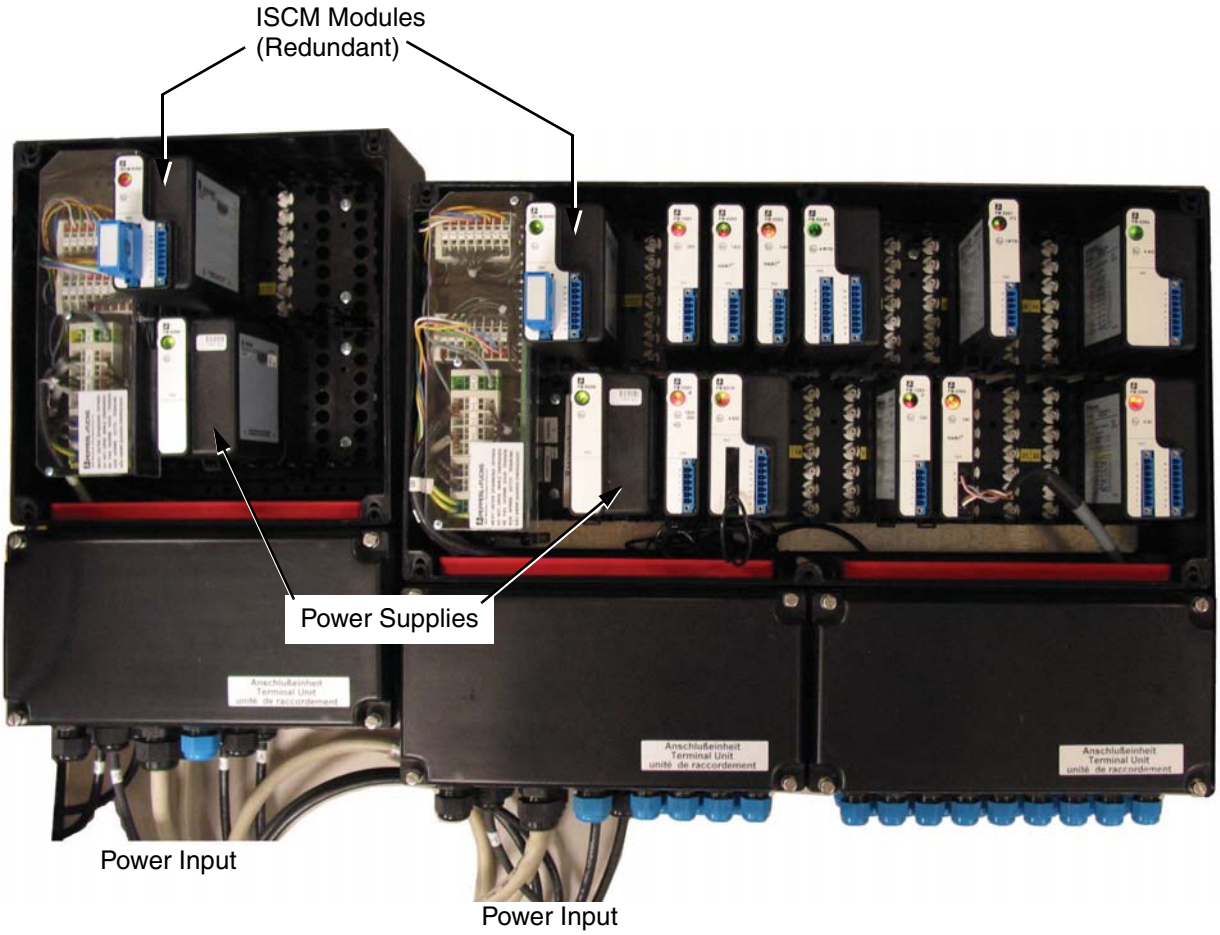


Figure 1-3. Redundant ISCMs in FB-Style Base and Redundancy Units (Zone 1 Applications)

The following I/A Series control processors support the ISCM:

- Field Control Processor 270 (FCP270) - with I/A Series version 8.4.3 with Quick Fix QF1012617 installed (and later)
- Z-Module Control Processor 270 (ZCP270) - with I/A Series version 8.4.3 with Quick Fix QF1012617 installed (and later)

Both LB- and FB-style applications support a total of 16 ISCMs per I/A Series control processor (FCP270, ZCP270 or later); a maximum of 204 modules (ISCMs, I/O modules and 200 Series FBMs) is supported per FCP270 and a maximum of 128 modules is supported per ZCP270, provided the maximum CP Fieldbus load and intrinsically safe I/O power supply load is not exceeded. Refer to Table 1-1 for a complete list of requirements.

To communicate with a ZCP270, the ISCM(s) must link to an optionally redundant FCM100E/Et module (shown in Figure 1-5 and Figure 1-6).Using a ZCP270 and multiple FCM100E/Ets may reduce the fieldbus loading but will not increase the maximum number of supported letterbugs over 128.

Connection diagrams are shown in Appendix A “CP270 to ISCM Connection Diagrams”.

— NOTE

The following 200 Series FBM features are not supported on the intrinsically safe I/O modules: Sequence of Events (SOE), TDR, time synchronization, ladder logic, and the EVENT, MDACT and DPIDA blocks.

— NOTE

When using the ISCM together with 200 Series FBMs under the same FCP270, the FEM100 module must be used to separate the fieldbus for the 200 Series FBMs from the FCP fieldbus. 100 Series FBMs are supported on an FCP270 as long as the FBI100 (Fieldbus Isolator) is used to separate the 100 Series FBMs modules from the FCP fieldbus. When using a ZCP270 with the ISCM, each ISCM must have a dedicated FCM100E/Et pair. 200 Series FBMs may also be supported on another FCM100E/Et pair.
100 Series FBMs may also be supported on yet another FCM100E pair. (100 Series FBMs are only supported by the FCM100E.)

— NOTE

The FCP270, 200 Series modules and their support hardware are suitable for Zone 2 areas only. Installing this equipment in a Zone 1 area requires the employment of additional protection methods and is the customer’s responsibility to implement.

IS/IO System Configuration Requirements

⚠ CAUTION

The FCP270 cannot support more than 204 I/O modules, ISCMs and FBMs. Significant operational issues and communication failures may occur if more than 204 modules are configured for this subsystem. Note that redundant ISCMs and redundant FBMs count as three modules; all others count as one.

The requirements in Table 1-1 must be met to ensure proper system operation:

Table 1-1. IS/IO System Configuration Requirements

Requirement	Each FCP270	Each ZCP270	Each Zone 2 (LB-Style) System	Each Zone 1 (FB-Style) System
Install in area(s)	Zone 2[1]	Zone 2[1]	Zone 2[1]	Zone 1 or Zone 2[1]
I/A Series software versions	8.4.3 with QF1012617 (and later)[2]	8.4.3 with QF1012617 (and later)[2]	8.4.3 with QF1012617 (and later)[2]	8.4.3 with QF1012617 (and later)[2]
Maximum number of I/O modules, ISCMs and FBMs	204 (Redundant ISCM pairs count as three modules)	128 (Redundant ISCM pairs count as three modules)	46 single width, 23 dual width or any I/O combination	48 single width, 24 dual width or any I/O combination
Maximum CP Fieldbus load	75% - Use loading spreadsheet (B0700AV)	75% - Use loading spreadsheet (B0700AW)	N/A	N/A
ISCMs supported	16 single or redundant pairs	16 single or redundant pairs	One or two per LB-style system	One or two per FB-style system
Power supplies	One or two Invensys® supplied 24 Volt power supplies, power input 24 V dc or 85 - 265 V ac (or 125 V dc)	One or two Invensys supplied 24 Volt power supplies, power input 24 V dc or 85 - 265 V ac (or 125 V dc)	P+F supplied, two per base or extension unit. Three per unit are required for redundant systems. External optionally redundant 24 V dc power input	P+F supplied, one in main unit, one in redundancy unit, two in extension unit. External power input 24 V dc, 115 V ac or 230 V ac mains
24 V dc Boost Power	N/A	N/A	Required if 6x10-6x15 modules are installed	Required if 6x10-6x15 modules are installed
Analog Inputs and Analog Outputs	Configuration dependent	Configuration dependent	80 total, 40 each per base or extension unit	80 total, 40 each per base or extension unit

Table 1-1. IS/IO System Configuration Requirements (Continued)

Requirement	Each FCP270	Each ZCP270	Each Zone 2 (LB-Style) System	Each Zone 1 (FB-Style) System
Digital I/O 2x02 modules	Configuration dependent	Configuration dependent	40 total, 20 each per base or extension unit	40 total, 20 each per base or extension unit
Other I/O Modules	Configuration dependent	Configuration dependent	Any other combination if the above two limits are not reached.	Any other combination if the above two limits are not reached.
Maximum number of HART devices	Maximum Fieldbus load cannot be exceeded	Maximum Fieldbus load cannot be exceeded	80	80
Maximum number of HART I/O point connections	480 points will use 29% of the fieldbus load capacity	480 points will use 35% of the fieldbus load capacity	480	480
Maximum number of HART pass through sessions	12	12	4	4

1. Be aware that Zone 1 and Zone 2 installations have other special requirements for power consumption and dissipation. These are observed automatically by P+F's ATEX audited factories. Other panel builders would have to obtain their own certificates equivalent to P+F's PTB07ATEX1075 for Zone 1 and PF08CERT1234 for Zone 2.
2. Windows XP and Windows Server 2003 workstation operating systems only.

Supported ISCMs, P+F Baseplates, P+F I/O Modules and Equipment

Table 1-2 lists the available ISCM modules and available support equipment.

Table 1-2. ISCM Modules and Support Equipment

Invensys Part No.	P+F Model No.	Description
P0924GT	ISCM8100	Intrinsically Safe Communication Module for Zone 2 (LB-style) applications
P0924GU	ISCM8200	Intrinsically Safe Communication Module for Zone 1 (FB-style) applications
P0924GV	LTBM8001	Letterbug rotary switch module (plugs into ISCM8100/8200)

Table 1-3 lists the supported P+F I/O base, redundancy and extension units and their associated enclosures and power supplies.

Table 1-3. P+F I/O Base/Extension Units, Enclosures and Power Supplies to Support the ISCM

P+F Model No.[1]	Description
LB 9022 F	Zone 2 Redundancy Base Unit with 22 slots for ISCM for Zone 2 (LB-style) applications (P0924GT)
LB 9024	Zone 2 Extension Unit with 24 slots
LB 9547-S70-F	Zone 2 stainless steel enclosure with 46 slots for Zone 2 (LB-style) applications (P0924GT)
LB 9006 C	Zone 2 power supply - 24 V dc input
FB 9224-PG0	Zone 1 GRP enclosure with 24 slots
FB 9225-PG0	Zone 1 GRP enclosure with 24 slots (redundant)
FB 9248-PG0	Zone 1 GRP enclosure with 48 slots
FB 9249-PG0	Zone 1 GRP enclosure with 48 slots (redundant)
FB 9224-S60	Zone 1 stainless steel enclosure with 24 slots
FB 9225-S70	Zone 1 stainless steel enclosure with 24 slots (redundant)
FB 9248-S70	Zone 1 stainless steel enclosure with 48 slots
FB 9249-S80	Zone 1 stainless steel enclosure with 48 slots (redundant)
FB 9205 D	Zone 1 power supply - 230 V ac / boost power for DO modules FB621x
FB 9206 D	Zone 1 power supply - 24 V dc input
FB 9215 B	Zone 1 power supply - 230 V ac input
FB 9216 B	Zone 1 power supply - 115 V ac input

1. Visit the IPS Portal (*www.ips.invensys.pepperl-fuchs.com*) to order this equipment as it does not have an Invensys part number.

Only intrinsically safe I/O modules from P+F that are listed in the tables which follow are supported by the ISCM. If it is desired to also include non-IS signals in the same I/A Series system, standard 200 Series FBMs must be used for these signals.

The comparable Fieldbus Modules (FBMs) are discussed in the *DIN Rail Mounted FBM Subsystem User's Guide* (B0400FA).

Supported P+F Intrinsically Safe I/O Modules and Front Connectors Specifications for Zone 2 or Class I, Div. 2 Environments

Table 1-4 lists the Pepperl+Fuchs intrinsically safe I/O modules supported by the ISCM in Zone 2 or Class I, Div. 2 environments.

Table 1-4. Supported P+F Intrinsically Safe I/O Modules (Zone 2)

P+F Model No.	I/O Channels				Description	Similar to FBM	BP Slot
	AI	AO	DI	DO			
LB 1101 A	-	-	2	-	Digital Input	207	1
LB 1103 F	-	-	2[1]	-	Frequency + direction of rotation (15 KHz)	206	1
LB 1104 F	-	-	2[1]	-	Pulse count + direction of rotation (15 KHz)	206	1
LB 1103 FL	-	-	2[1]	-	Frequency low + direction of rotation (300 Hz)	206	1
LB 1104 FL	-	-	2[1]	-	Pulse count low + direction of rotation (300 Hz)	206	1
LB 1108 A	-	-	8	-	Digital Input	207	2
LB 2101 A	-	-	2	1	Digital Output with position feedback (22 V, 315 Ω)	241	1
LB 2101 E	-	-	2	1	Digital Output with position feedback + shutdown input (22 V, 315 Ω)	241	1
LB 2102 A	-	-	2	1	Digital Output with position feedback (24 V, 210 Ω)	241	1
LB 2103 A	-	-	2	1	Digital Output with position feedback (24 V, 360 Ω)	241	1
LB 2103 E	-	-	2	1	Digital Output with position feedback + shutdown input (24 V, 360 Ω)	241	1
LB 2104 A	-	-	2	1	Digital Output with position feedback (22 V, 220 Ω)	241	1
LB 2105 A	-	-	2	1	Digital Output with position feedback (22.8 V, 290 Ω)	241	1
LB 2105 E	-	-	2	1	Digital Output with position feedback + shutdown input (22.8 V, 290 Ω)	241	1

Table 1-4. Supported P+F Intrinsically Safe I/O Modules (Zone 2) (Continued)

P+F Model No.	I/O Channels				Description	Similar to FBM	BP Slot
	AI	AO	DI	DO			
LB 2112 A	-	-	2	1	Digital Output with position feedback (25.3 V, 329 Ω)	241	1
LB 2112 E	-	-	2	1	Digital Output with position feedback + shutdown input (25.3 V, 329 Ω)	241	1
LB 2113 A	-	-	2	1	Digital Output with position feedback (26.7 V, 509 Ω)	241	1
LB 2113 E	-	-	2	1	Digital Output with position feedback + shutdown input (26.7 V, 509 Ω)	241	1
LB 3102 A	1	-	-	-	HART® input with Transmitter power (16.5V)	214	1
LB 3104 A	4	-	-	-	Transmitter power	201	2
LB 3105 A	4	-	-	-	HART® and Transmitter power	214	2
LB 4102 A	-	1	-	-	HART® output	215	1
LB 4102 C	-	1	-	-	HART® output with shutdown input	215	1
LB 4104 A	-	4	-	-	Analog Output	237	2
LB 4105 C	-	4	-	-	HART® output with shutdown input	215	2
LB 4105 D	-	4	-	-	HART® output with LFD	215	2
LB 5101 F3	1	-	-	-	3-wire RTD input	203	1
LB 5101 F4	1	-	-	-	4-wire RTD input	203	1
LB 5102 F	1	-	-	-	T/C with internal/external CJC RTD input	202	1
LB 5106 A	1	-	-	-	0 - 10 V input	201	1
LB 5104 F3	4	-	-	-	3 wire RTD input	203	2
LB 5104 F4	4	-	-	-	4 wire RTD input	203	2
LB 5105 F	4	-	-	-	T/C with internal CJC RTD	202	2
LB 6101 H	-	-	-	2	Digital Relay Output (230 V/24 V)	242	1
LB 6005 A	-	-	-	4	Digital Relay Output (230 V/24 V)	242	2
LB 6006 A	-	-	-	8	Digital Relay Output (24 V)	242	2
LB 6108 A	-	-	-	8	20V/8 mA Digital Output per channel, with shut down input	242	2
LB 6110 A	-	-	-	4	Solenoid driver uses boost power (24.5 V, 370 Ω)	242	2
LB 6110 E	-	-	-	4	Solenoid driver uses boost power + shutdown input (24.5 V, 370 Ω)	242	2
LB 6111 A	-	-	-	4	Solenoid driver uses boost power (24.5 V, 320 Ω)	242	2
LB 6111 E	-	-	-	4	Solenoid driver uses boost power + shutdown input (24.5 V, 320 Ω)	242	2

Table 1-4. Supported P+F Intrinsically Safe I/O Modules (Zone 2) (Continued)

P+F Model No.	I/O Channels				Description	Similar to FBM	BP Slot
	AI	AO	DI	DO			
LB 6112 A	-	-	-	4	Solenoid driver uses boost power (17 V, 185 Ω)	242	2
LB 6112 E	-	-	-	4	Solenoid driver uses boost power + shutdown input (17 V, 185 Ω)	242	2
LB 6113 A	-	-	-	4	Solenoid driver uses boost power (23 V, 290 Ω)	242	2
LB 6113 E	-	-	-	4	Solenoid driver uses boost power + shutdown input (23 V, 290 Ω)	242	2
LB 6114 A	-	-	-	4	Solenoid driver uses boost power (23 V, 355 Ω)	242	2
LB 6114 E	-	-	-	4	Solenoid driver uses boost power + shutdown input (23 V, 355 Ω)	242	2
LB 6115 A	-	-	-	4	Solenoid driver uses boost power (16.2 V, 78 Ω)	242	2
LB 6115 ES	-	-	-	4	Solenoid driver uses boost power + shutdown input (16.2 V, 78 Ω)	242	2

[1.] Although these modules have two channels, the second channel is for direction detection only.

Table 1-5 lists the front connectors used with the Pepperl+Fuchs intrinsically safe I/O modules listed in Table 1-4. These front connector types are shown in Figure 1-4.

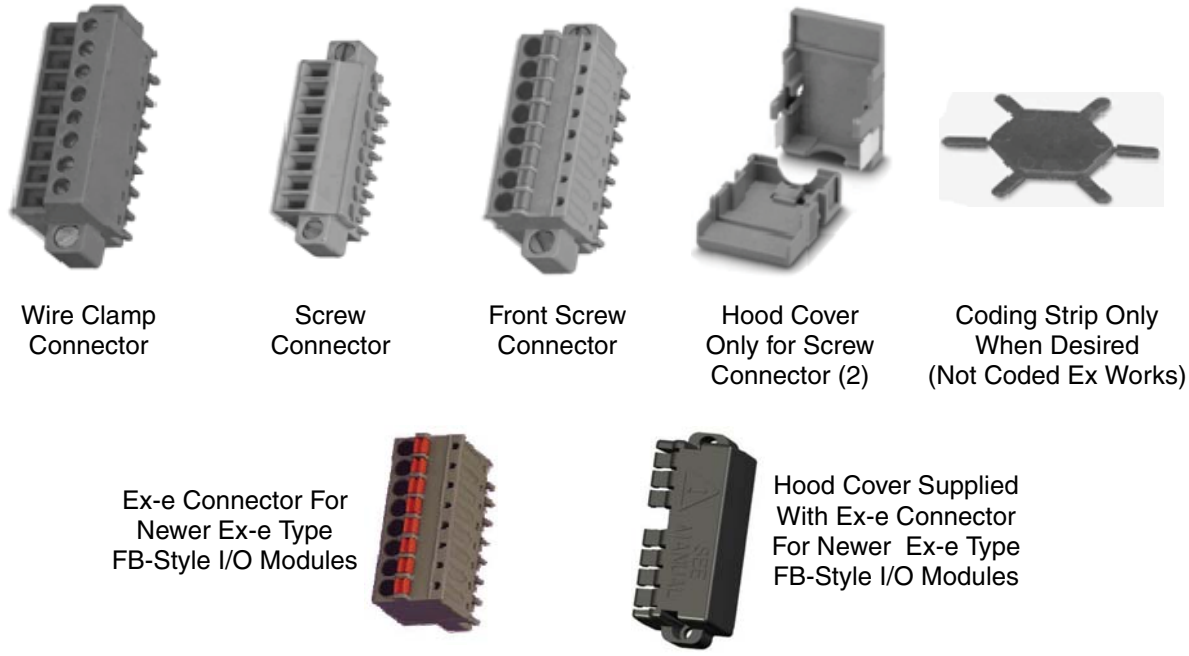


Figure 1-4. Front Connector Types for Supported P+F Intrinsically Safe I/O Modules (Zones 1 and 2)

Table 1-5. Front Connectors for Supported P+F Intrinsically Safe I/O Modules (Zone 2)

P+F Model No.	Description	Signal Type
6 Pole Front Connectors		
LB 9007 A	Screw terminals connector, green, 6-pole	Non-Intrinsically Safe
LB 9008 A	Cover for connector green, 6-pole	Non-Intrinsically Safe
LB 9009 A	Wire clamp connector green, 6-pole	Non-Intrinsically Safe
LB 9107 A	Screw terminals connector blue, 6-pole	Intrinsically Safe
LB 9107 P	Wire clamp connector blue, 6-pole	Intrinsically Safe
LB 9108 A	Cover for connector blue, 6-pole	Intrinsically Safe
LB 9111 A	Cold junction module with hood, blue, 6-pole	Intrinsically Safe
LB 9117 A	Front screw connector, blue, 6-pole	Intrinsically Safe
8 Pole Front Connectors		
LB 9013 A	Screw terminals connector green, 8-pole	Non-Intrinsically Safe
LB 9014 A	Screw terminals connector green, 2 x 8-pole, with label 1-8 and 9-16	Non-Intrinsically Safe
LB 9015 A	Wire clamp connector green, 8-pole	Non-Intrinsically Safe
LB 9016 A	Wire clamp connector green, 2 x 8-pole, with label 1-8 and 9-16	Non-Intrinsically Safe
LB 9018 A	Front screw connector 1-8, green	Non-Intrinsically Safe
LB 9019 A	Front screw connector 1-8 and 9-16, green	Non-Intrinsically Safe
LB 9113 A	Screw terminals connector blue, 8-pole	Intrinsically Safe
LB 9124 A	Screw terminals connector blue, 2 x 8-pole, with label 1-8 and 9-16	Intrinsically Safe
LB 9115 A	Wire clamp connector blue, 8-pole	Intrinsically Safe
LB 9116 A	Wire clamp connector blue, 2 x 8-pole, with label 1-8 and 9-16	Intrinsically Safe
LB 9118 A	Front screw connector 1-8, blue	Intrinsically Safe
LB 9119 A	Front screw connector, 2 x 8-pole. 1-8 and 9-16, blue	Intrinsically Safe
LB 9120 A	Cover for connector blue, 8-pole	Intrinsically Safe
LB 9020 A	Coding strip for coding the male connector (100 pcs.)	n/a

Supported P+F Intrinsically Safe I/O Modules and Front Connectors Specifications for Zone 1 Environments

Table 1-6 lists the Pepperl+Fuchs intrinsically safe I/O modules supported by the ISCM in Zone 1 environments.

— NOTE

Certain FB-Style (Zone 1) I/O modules supporting Ex-e terminals use cable tails to attach the EX-e connectors. Newer I/O modules are available with plug-in front EX-e connectors instead of cable tails - as shown in Figure 1-4. This simplifies installation and the new EX-e terminals no longer require marshalling. The new cage clamp type plug-in connectors are covered by a hood to ensure IP30 protection, as shown in Figure 1-4. Plastic lugs on the hood ensure that every opening is covered unless occupied by a field wire. Lugs are broken off as more wires are used. Once screwed down, the hood cover secures the connector to the module.

Table 1-6. Supported P+F Intrinsically Safe I/O Modules (Zone 1)

P+F Model No.	I/O Channels				Description	Similar to FBM	BP Slot
	AI	AO	DI	DO			
FB 1201 B	-	-	2	-	Digital Input	207	1
FB 1203 F	-	-	2[1]	-	Frequency + direction of rotation (15 KHz)	206	1
FB 1204 F	-	-	2[1]	-	Pulse count + direction of rotation (15 KHz)	206	1
FB 1203 FL	-	-	2[1]	-	Frequency low + direction of rotation (300 Hz)	206	1
FB 1204 FL	-	-	2[1]	-	Pulse count low + direction of rotation (300 Hz)	206	1
FB 1208 B	-	-	8	-	Digital Input	207	2
FB 1301 B FB 1301 B200[2]	-	-	2	-	Increased safety (NON IS) Digital Input	207	1
FB 1303 F FB 1303 F2[2]	-	-	2[1]	-	Frequency + direction of rotation (15 KHz)	206	1
FB 1303 FL FB 1303 FL2[2]	-	-	2[1]	-	Frequency low + direction of rotation (300 Hz)	206	1
FB 1304 F FB 1304 F2[2]	-	-	2[1]	-	Pulse count + direction of rotation (15 KHz)	206	1
FB 1304 FL FB 1304 FL2[2]	-	-	2[1]	-	Pulse count low + direction of rotation (300 Hz)	206	1
FB 1308 B FB 1308 B200[2]	-	-	8	-	Digital Input	207	2
FB 2201 B	-	-	2	1	Digital Output with position feedback (22 V, 315 Ω)	241	1

Table 1-6. Supported P+F Intrinsically Safe I/O Modules (Zone 1) (Continued)

P+F Model No.	I/O Channels				Description	Similar to FBM	BP Slot
	AI	AO	DI	DO			
FB 2201 E	-	-	2	1	Digital Output with position feedback + shutdown input (22 V, 315 Ω)	241	1
FB 2202 B	-	-	2	1	Digital Output with position feedback (24 V, 210 Ω)	241	1
FB 2203 B	-	-	2	1	Digital Output with position feedback (24 V, 360 Ω)	241	1
FB 2203 E	-	-	2	1	Digital Output with position feedback + shutdown input (24 V, 360 Ω)	241	1
FB 2204 B	-	-	2	1	Digital Output with position feedback (22 V, 220 Ω)	241	1
FB 2205 B	-	-	2	1	Digital Output with position feedback (22.8 V, 290 Ω)	241	1
FB 2205 E	-	-	2	1	Digital Output with position feedback + shutdown input (22.8 V, 290 Ω)	241	1
FB 2212 B	-	-	2	1	Digital Output with position feedback (25.3 V, 329 Ω)	241	1
FB 2212 E	-	-	2	1	Digital Output with position feedback + shutdown input (25.3 V, 329 Ω)	241	1
FB 2213 B	-	-	2	1	Digital Output with position feedback (26.7 V, 509 Ω)	241	1
FB 2213 E	-	-	2	1	Digital Output with position feedback + shutdown input (26.7 V, 509 Ω)	241	1
FB 3202 B	1	-	-	-	HART® input with Transmitter power (16.5V)	214	1
FB 3204 B	4	-	-	-	Transmitter power	201	2
FB 3205 B	4	-	-	-	HART® and Transmitter power	214	2
FB 3302 B FB 3302 B200[2]	1	-	-	-	HART® input with Transmitter power (16.5V)	214	1
FB 3305 B FB 3305 B200[2]	4	-	-	-	HART® and Transmitter power	214	2
FB 4202 B	-	1	-	-	HART® output	215	1
FB 4202 C	-	1	-	-	HART® output with shutdown input	215	1
FB 4302 C FB 4302 C200[2]	-	1	-	-	HART® output with shutdown input	215	1
FB 4204 B	-	4	-	-	Analog Output	237	2
FB 4205 C	-	4	-	-	HART® output with shutdown input	215	2
FB 4205 D	-	4	-	-	HART® output with LFD	215	2
FB 4305 B FB 4305 B200[2]	-	4	-	-	HART® output with Ex-e	215	2

Table 1-6. Supported P+F Intrinsically Safe I/O Modules (Zone 1) (Continued)

P+F Model No.	I/O Channels				Description	Similar to FBM	BP Slot
	AI	AO	DI	DO			
FB 5201 F3	1	-	-	-	3 wire RTD input	203	1
FB 5201 F4	1	-	-	-	4 wire RTD input	203	1
FB 5202 F	1	-	-	-	T/C with internal/external CJC RTD input	202	1
FB 5204 F3	4	-	-	-	3 wire RTD input	203	2
FB 5204 F4	4	-	-	-	4 wire RTD input	203	2
FB 5205 F	4	-	-	-	T/C with internal CJC RTD	202	2
FB 5206 B	1	-	-	-	0 - 10 V input	201	1
FB 6208 B	-	-	-	8	20V/8mA Digital Output per channel, with shutdown input	242	2
FB 6210 B	-	-	-	4	Solenoid driver uses boost power (24.5 V, 370 Ω)	242	2
FB 6210 E	-	-	-	4	Solenoid driver uses boost power+ shut-down input (24.5 V, 370 Ω)	242	2
FB 6211 B	-	-	-	4	Solenoid driver use boost power (24.5 V, 320 Ω)	242	2
FB 6211 E	-	-	-	4	Solenoid driver uses boost power+ shut-down input (24.5 V, 320 Ω)	242	2
FB 6212 B	-	-	-	4	Solenoid driver uses boost power (17.5 V, 185 Ω)	242	2
FB 6212 E	-	-	-	4	Solenoid driver uses boost power+ shut-down input (17.5 V, 185 Ω)	242	2
FB 6213 B	-	-	-	4	Solenoid driver uses boost power (23 V, 290 Ω)	242	2
FB 6213 E	-	-	-	4	Solenoid driver uses boost power+ shut-down input (23 V, 290 Ω)	242	2
FB 6214 B	-	-	-	4	Solenoid driver uses boost power (23 V, 355 Ω)	242	2
FB 6214 E	-	-	-	4	Solenoid driver uses boost power+ shut-down input (23 V, 355 Ω)	242	2
FB 6215 B	-	-	-	4	Solenoid driver uses boost power (16.2 V, 78 Ω)	242	2
FB 6215 ES	-	-	-	4	Solenoid driver uses boost power+ shut-down input (16.2 V, 78 Ω)	242	2
FB 6301 H200	-	-	-	2	Digital Relay Output (230 V/24 V)	242	1
FB 6305 B200	-	-	-	4	Digital Relay Output (230 V/24 V)	242	2
FB 6306 B FB 6306 B200[2]	-	-	-	8	Digital Relay Output (24 V)	242	2

Table 1-6. Supported P+F Intrinsically Safe I/O Modules (Zone 1) (Continued)

P+F Model No.	I/O Channels				Description	Similar to FBM	BP Slot
	AI	AO	DI	DO			
FB 6308 B FB 6308 B200[2]	-	-	-	8	20V/8mA Digital Output per channel, with shutdown input	242	2
FB 9293 F	-	-	-	-	HDLC Bus Termination Module	-	1

1. Although these modules have two channels, the second channel is for direction detection only.
2. This FB-style I/O module has front-mounted Ex-e connector with cable tails. A newer I/O module, listed above this I/O module in the same table cell, is available for this I/O module with a plug-in front EX-e connector instead of cable tails.

Table 1-7 lists the front connectors used with the Pepperl+Fuchs intrinsically safe I/O modules listed in Table 1-6. These front connector types are the same as shown in Figure 1-4 on page 9.

Table 1-7. Front Connectors for Supported P+F Intrinsically Safe I/O Modules (Zone 1)

P+F Model No.	Description	Signal Type
6 Pole Front Connectors		
LB 9107 A	Screw terminals connector blue, 6-pole	Intrinsically Safe
LB 9107 P	Wire clamp connector blue, 6-pole	Intrinsically Safe
LB 9108 A	Cover for connector blue, 6-pole, (watch enclosure depth)	Intrinsically Safe
LB 9111 A	Cold junction module with hood, blue, 6-pole (watch enclosure depth)	Intrinsically Safe
LB 9112 A	Cold junction module without hood, blue, 6-pole	Intrinsically Safe
LB 9117 A	Front screw connector, blue, 6-pole	Intrinsically Safe
8 Pole Front Connectors		
LB 9113 A	Screw terminals connector blue, 8-pole	Intrinsically Safe
LB 9124 A	Screw terminals connector blue, 2 x 8-pole, with label 1-8 and 9-16	Intrinsically Safe
LB 9115 A	Wire clamp connector blue, 8-pole	Intrinsically Safe
LB 9116 A	Wire clamp connector blue, 2 x 8-pole, with label 1-8 and 9-16	Intrinsically Safe
LB 9118 A	Front screw connector 1-8, blue	Intrinsically Safe
LB 9119 A	Front screw connector, 2 x 8-pole. 1-8 and 9-16, blue	Intrinsically Safe
LB 9120 A	Cover for connector blue, 8-pole, (watch enclosure depth)	Intrinsically Safe
LB 9020 A	Coding strip for coding the male connector (100 pcs.)	n/a

Intrinsically Safe I/O Modules Specifications

Full details and specifications for the supported P+F I/O modules are found in *Intrinsically Safe I/O Subsystem* (PSS 21H-2Y6 B4).

I/O Communications

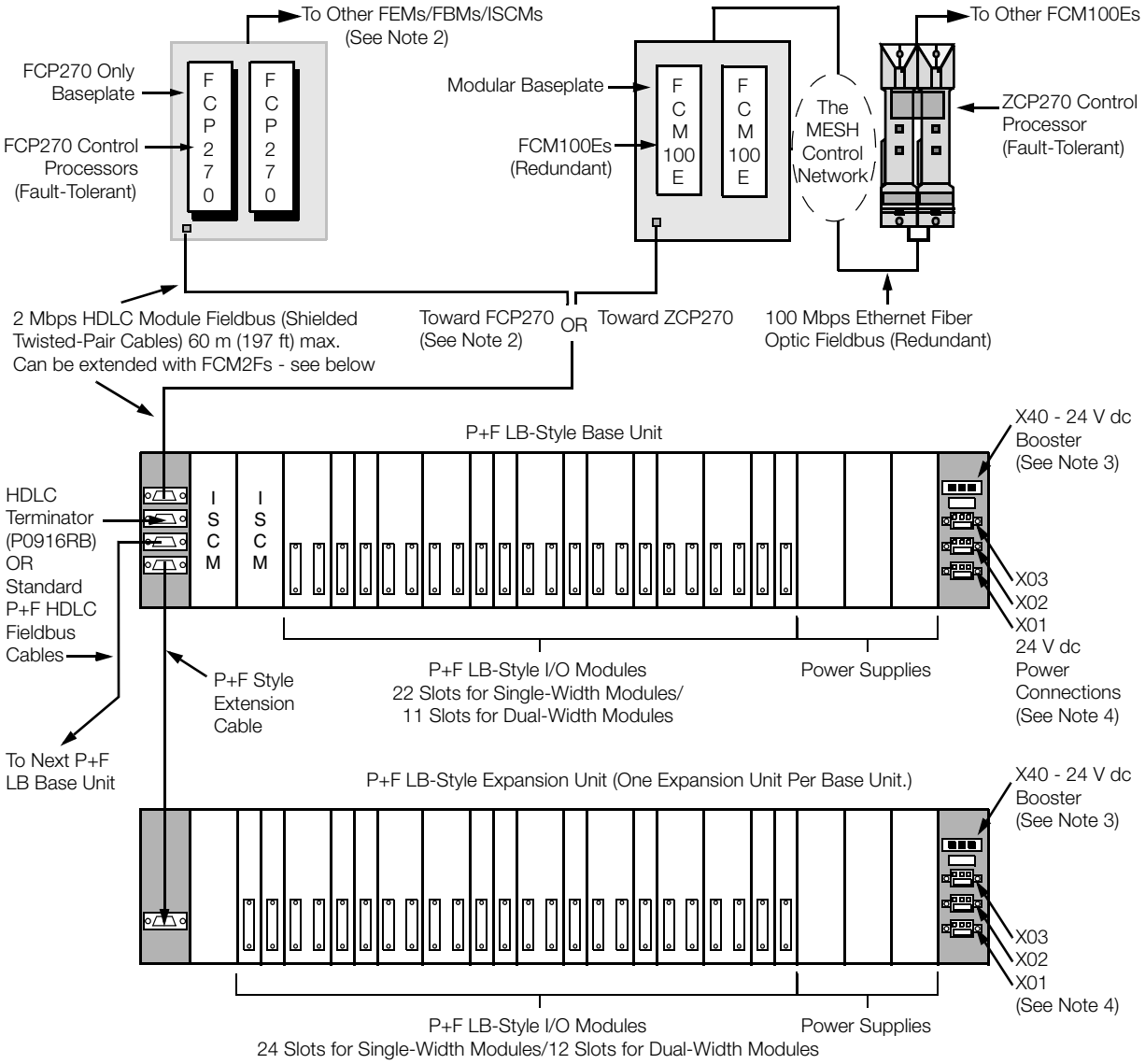
The ISCM communicates with the I/A Series control processor via a 2 Mbps HDLC fieldbus shown in Figure 1-5 and Figure 1-6, via the standard protocols supported by these control processors (HART®, FOUNDATION™ fieldbus, Profibus, Modbus, FoxCom™, FDSI and standard 200 Series FBMs). The 2 Mbps HDLC fieldbus is connected to both paths of the redundant fieldbus network, providing continuous communication in the event one path fails.

The ISCM may connect directly to a FCP270 over the 2 Mbps HDLC fieldbus. To connect to a ZCP270, the ISCM connects to an FCM100E/Et module, which in turn connects to the ZCP270 over a 100 Mbps Ethernet fiber optic network.

I/O communications support the following multiple data streams:

- Real-time I/O
- I/O maintenance activity
- Pass-through activity for HART device configuration.

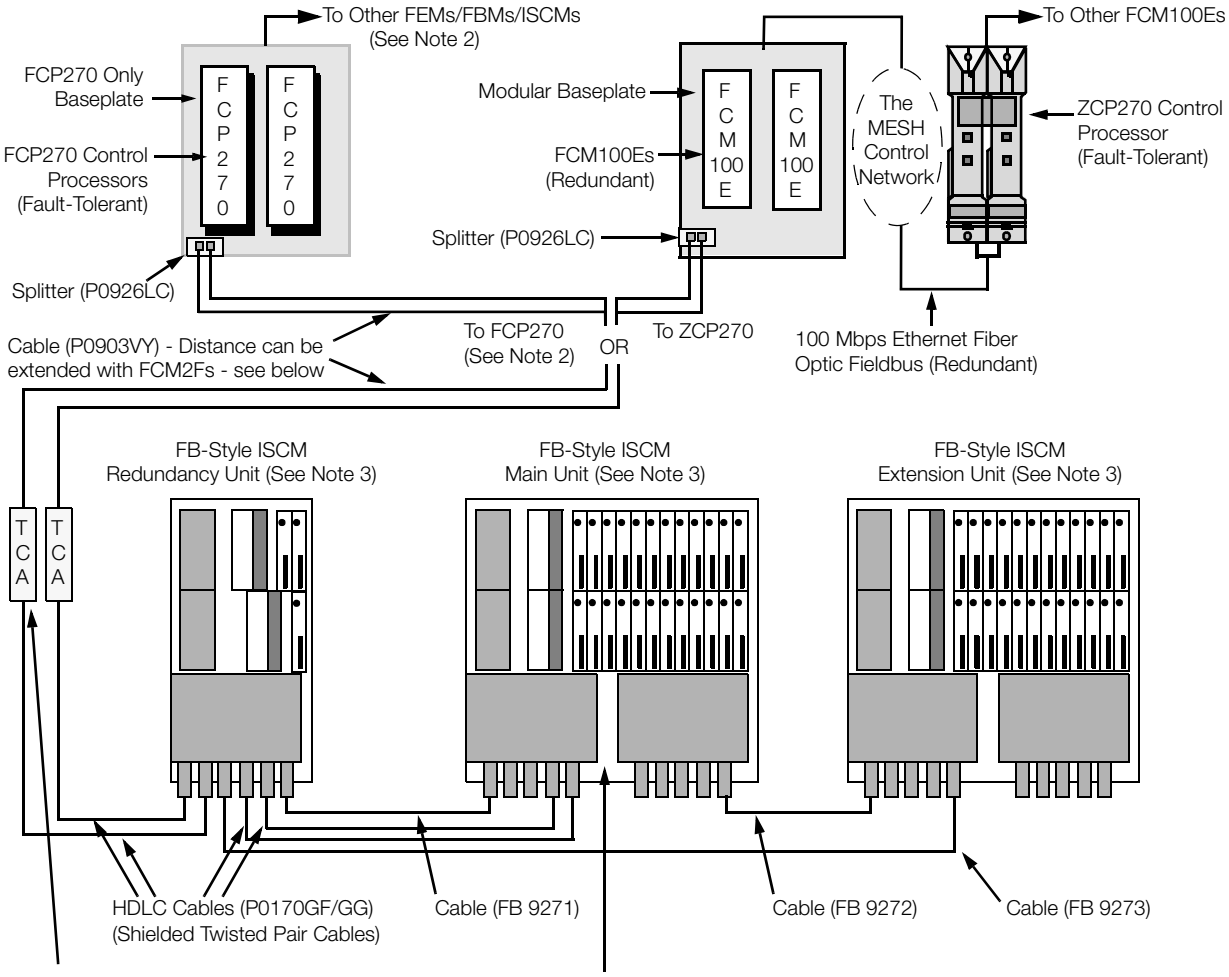
Figure 1-5 and Figure 1-6 provide a simplified overview of communications to/from the LB-style and FB-style base/extension units. For more detailed illustrations, refer to Appendix A “CP270 to ISCM Connection Diagrams” on page 131.



Notes:

1. For sizing constraints, refer to the next section below.
2. If FEM100 is used with an FCP270 connected to a P+F base/extension unit, there are limitations on the Expansion Fieldbus. See Appendix A. FEM100s cannot be directly connected to a P+F base/extension unit.
3. X40 - 24 V dc Booster provides extra auxiliary power for the 4-channel digital outputs for the LB 6110 to LB6115 I/O modules.
4. X03 provides power for the shutdown input. Alternatively, shutdown input can be done by use of a contact closure (contact input) to this connector.
   X02 and X01 are for the 24 V dc input power connections.

Figure 1-5. LB-Style ISCM to FCP270/ZCP270 I/O Communications (Simplified)



Notes:

1. For sizing constraints, refer to the next section below.
2. If FEM100 is used with an FCP270 connected to a P+F base/extension unit, there are limitations on the Expansion Fieldbus. See Appendix A. FEM100s cannot be directly connected to a P+F base/extension unit.
3. FB 9249-PG0 enclosure configuration is shown in this figure. Additional enclosure configurations are available. ISCMs are plugged into the Main or Redundancy Unit.

Figure 1-6. FB-Style ISCM to FCP270/ZCP270 I/O Communications (Simplified)

The distance between the FCP270 and the LB-style and FB-style units can be extended up to 10 km (6.2 mi) using fiber optic cabling and the FCM2F Fieldbus Communications modules, as shown in Figure 1-7. The three versions of the FCM2Fs – FCM2F2 (P0914YZ), FCM2F4 (P0917JA), and FCM2F10 (P0916TQ) – offer three different maximum fiber optic cabling distances: up to 2 km (1.24 mi), up to 4 km (2.48 mi), and up to 10 km (6.2 mi), respectively. FCM2F2 and FCM2F4 are used with multimode graded-index fiber cable, and FCM2F10 is used with single-mode fiber cable. They are discussed in *Fieldbus Communications Module, FCM2F2/FCM2F4/FCM2F10* (PSS 21H-2Y3 B3) and *DIN Rail Mounted Subsystem User's Guide* (B0400FA).

NOTE

The FCP270, 200 Series modules and their support hardware are suitable for Zone 2 or Class I, Div.2 areas only. Installing this equipment in a Zone 1 area requires the employment of additional protection methods and is the customer's responsibility to implement.

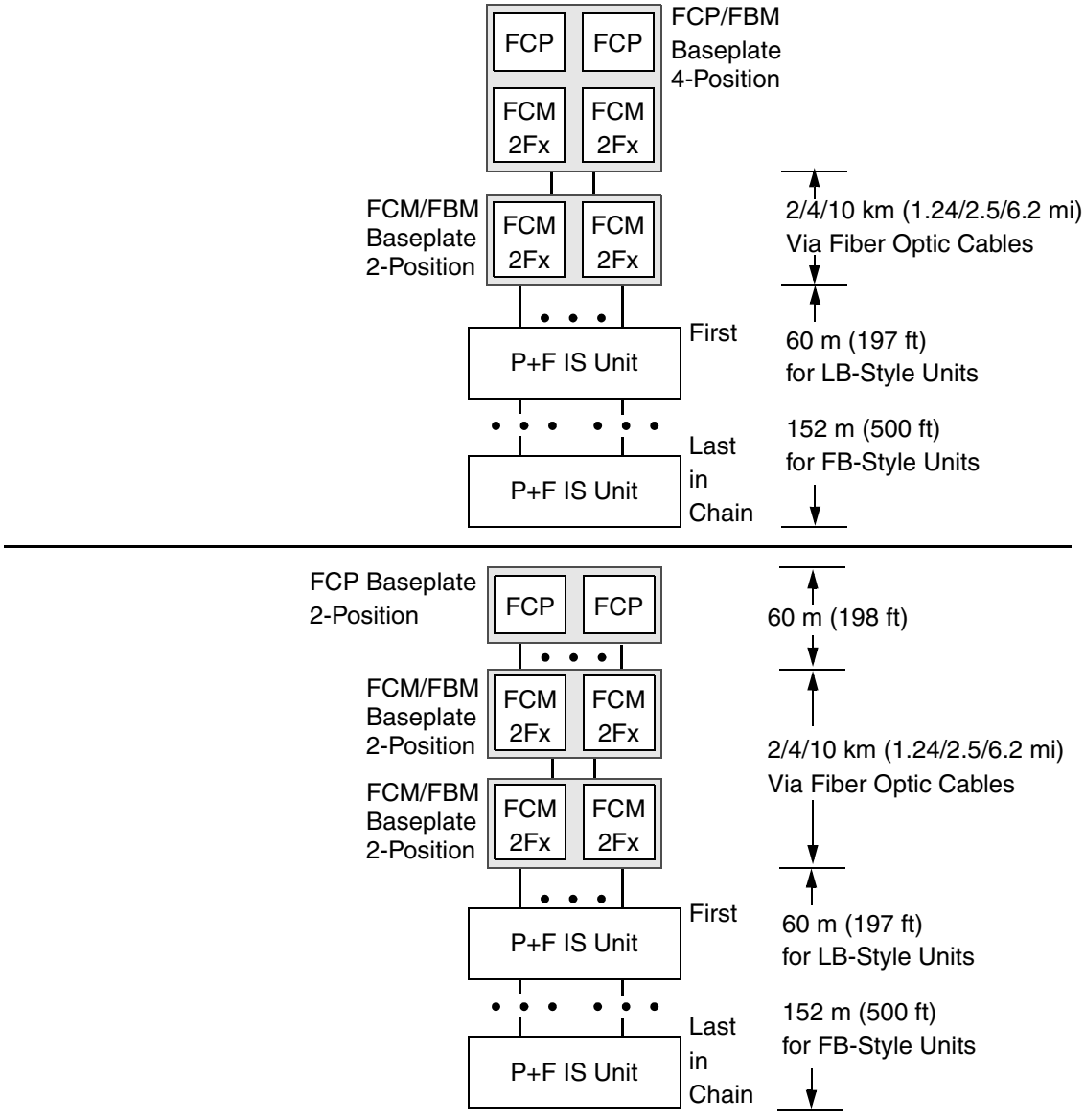


Figure 1-7. LB-Style and FB-Style ISCM to FCP270 I/O Communications via FCM2Fs (Simplified)

The FCP270 can connect to both P+F I/O modules and 200 Series FBMs, provided the appropriate sizing constraints are followed. The FCP270 must use the FEM100 to add up to three Expanded Fieldbuses for the 200 Series FBMs, while it connects directly to the ISCM base/extension unit. This is shown in Appendix A "CP270 to ISCM Connection Diagrams".

NOTE

When an FCP270 is connected to both P+F I/O modules and 200 Series FBMs via an FEM100, the Expanded Fieldbus 1 cannot be connected to any FBM baseplates (must be left disconnected), and Expanded Fieldbus 2 can only be used with FBM baseplates addresses 1, 2 and 3 to avoid letterbug addressing conflicts. Expanded Fieldbus 2 and 3 can connect and address all four baseplates (0 through 3).

For more information on the FEM100 and the Expanded Fieldbus, refer to *FEM100 Fieldbus Expansion Module* (PSS 21H-2Y16 B4) and "FEM100 Fieldbus Expansion Module" in *DIN Rail Mounted Subsystem User's Guide* (B0400FA).

As well, the ZCP270 can connect to both P+F I/O modules and 200 Series FBMs using a dedicated FCM100E/Et pair, provided the appropriate sizing constraints are followed.

A maximum of 48 P+F I/O modules are allowed per ISCM, with a total of 16 ISCMs per FCP270/ZCP270; subject to the standard Fieldbus load limits (discussed in *DIN Rail Mounted Subsystem User's Guide* (B0400FA)).

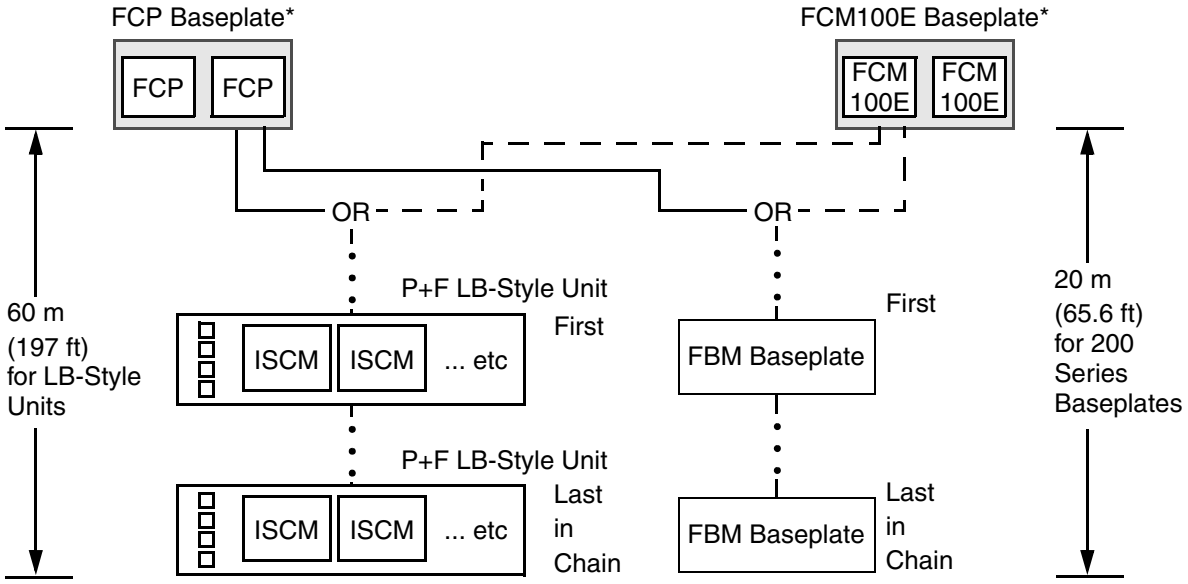
NOTE

Sixteen ISCMs represent the theoretical maximum if the units are not fully fitted with modules. Sixteen base units with sixteen extension units will connect a total of 16 x 46 I/O modules (736). The controller can handle up to 204. If dual-width modules are used, then the subsystem will have 16 x 23 dual-width I/O modules (368) which is outside the scope of the subsystem. In typical scenarios, eight units can be connected to one FCP270.

Fieldbus Cabling for Intrinsically Safe I/O Subsystem

Cabling lengths for the Intrinsically Safe I/O Subsystem with an FCP270/ZCP270 differ slightly from those used in the typical 200 Series subsystem, as follows:

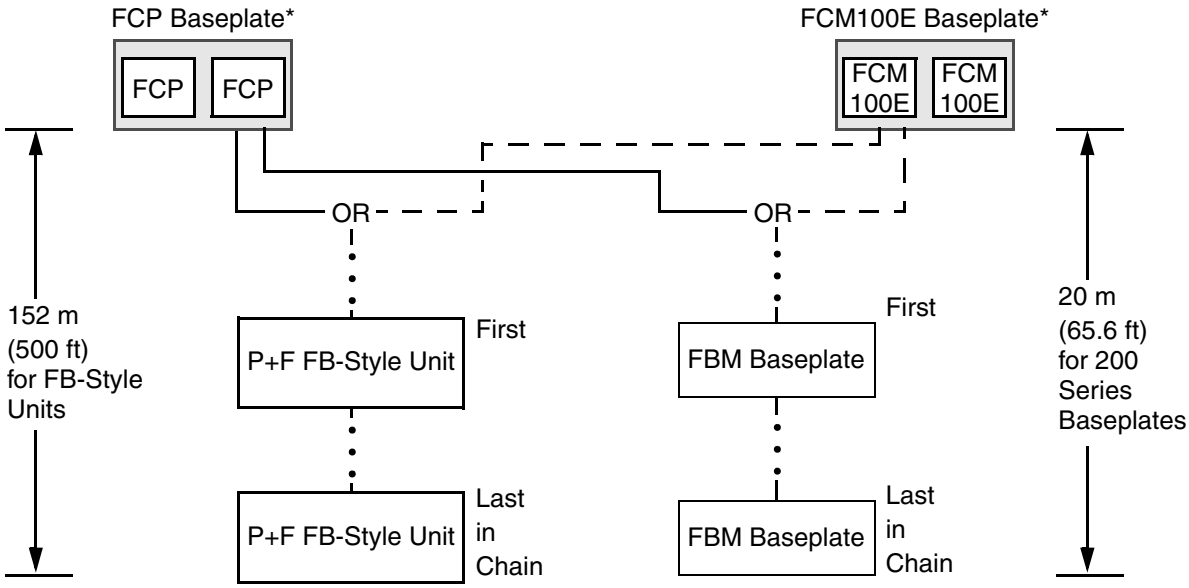
- For Zone 2 applications, a maximum of 60 meters (197 ft) of standard HDLC field-bus cable may be used between the FCP270 or FCM100E/Et and the last P+F LB-style unit in an Intrinsically Safe I/O Subsystem, as shown in Figure 1-8.
- Fieldbus cables which run from 200 Series FBM baseplates to the FCP270 or FCM100E/Et can be up to 20 m (65.6 ft) end to end, as shown in Figure 1-8, using standard fieldbus cables listed in Table 3-1 on page 35



* FCP Baseplate cannot connect to both Intrinsically Safe Units and 200 Series FBM Baseplates, while FCM100E Baseplate can connect only to one or the other.

Figure 1-8. Fieldbus Cable Length Restrictions for FCP270, FCM100E and LB-Style Intrinsically Safe Units

- For Zone 1 applications, a maximum of 152 meters (500 ft) of high quality twinaxial cable may be used between the FCP270 or FCM100E/Et (with the P0926LC Splitter) and the last P+F FB-style unit in an Intrinsically Safe I/O Subsystem, as shown in Figure 1-9.



* FCP Baseplate cannot connect to both Intrinsically Safe Units and 200 Series FBM Baseplates, while FCM100E Baseplate can connect only to one or the other.

Figure 1-9. Fieldbus Cable Length Restrictions for FCP270, FCM100E and FB-Style Intrinsically Safe Units

- Fieldbus cable length between an FBI100 and 100 Series FBMs, when used with an FCP270 connected to the Intrinsically Safe I/O Subsystem, can be up to 1829 m (6000 ft) end to end using twinaxial (shielded twisted-pair) cables
- Fieldbus cable length from an FCP270/FEM input to an ISCM's unit (LB-style or FB-style) can be up to 60 m (197 ft) end to end. The FCP270 can be at an end or in the middle of this length (if multiple P+F units are connected to one FCP270). See Figure 1-10.

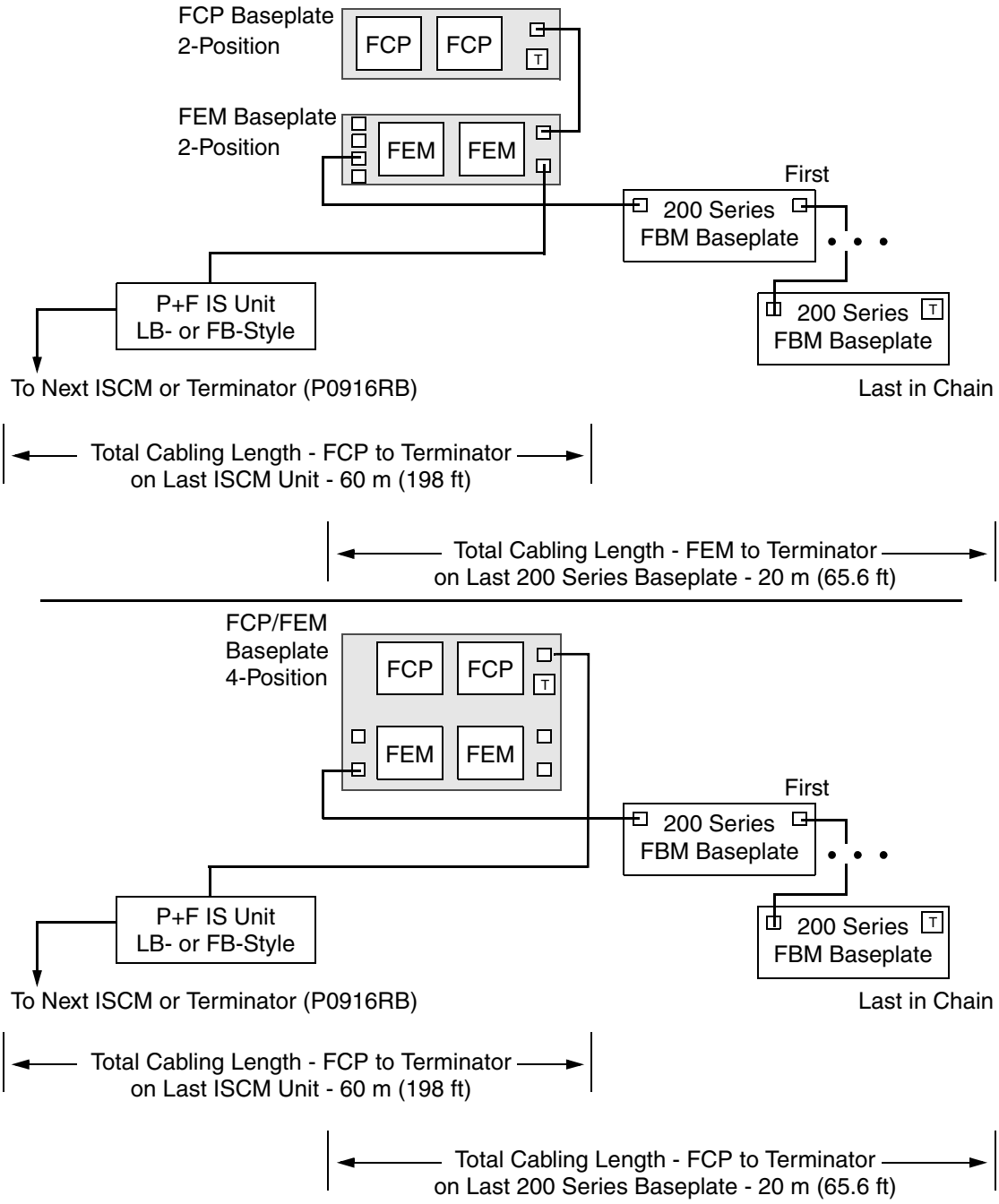


Figure 1-10. Fieldbus Cable Length Restrictions for FCP270, FEM100 and Intrinsically Safe Units without FCM2Fs

- When used with FCM2Fs to connect the FCP270/FEM to the ISCM's unit, the Fieldbus cable length from the nearest FCM2F pair input to ISCM's unit (LB-style or FB-style) can be up to 60 m (197 ft) end to end. See Figure 1-11. The nearest FCM2F pair can be at an end or in the middle of this length (if multiple P+F units are connected to one FCP270), as shown in Figure 1-11.

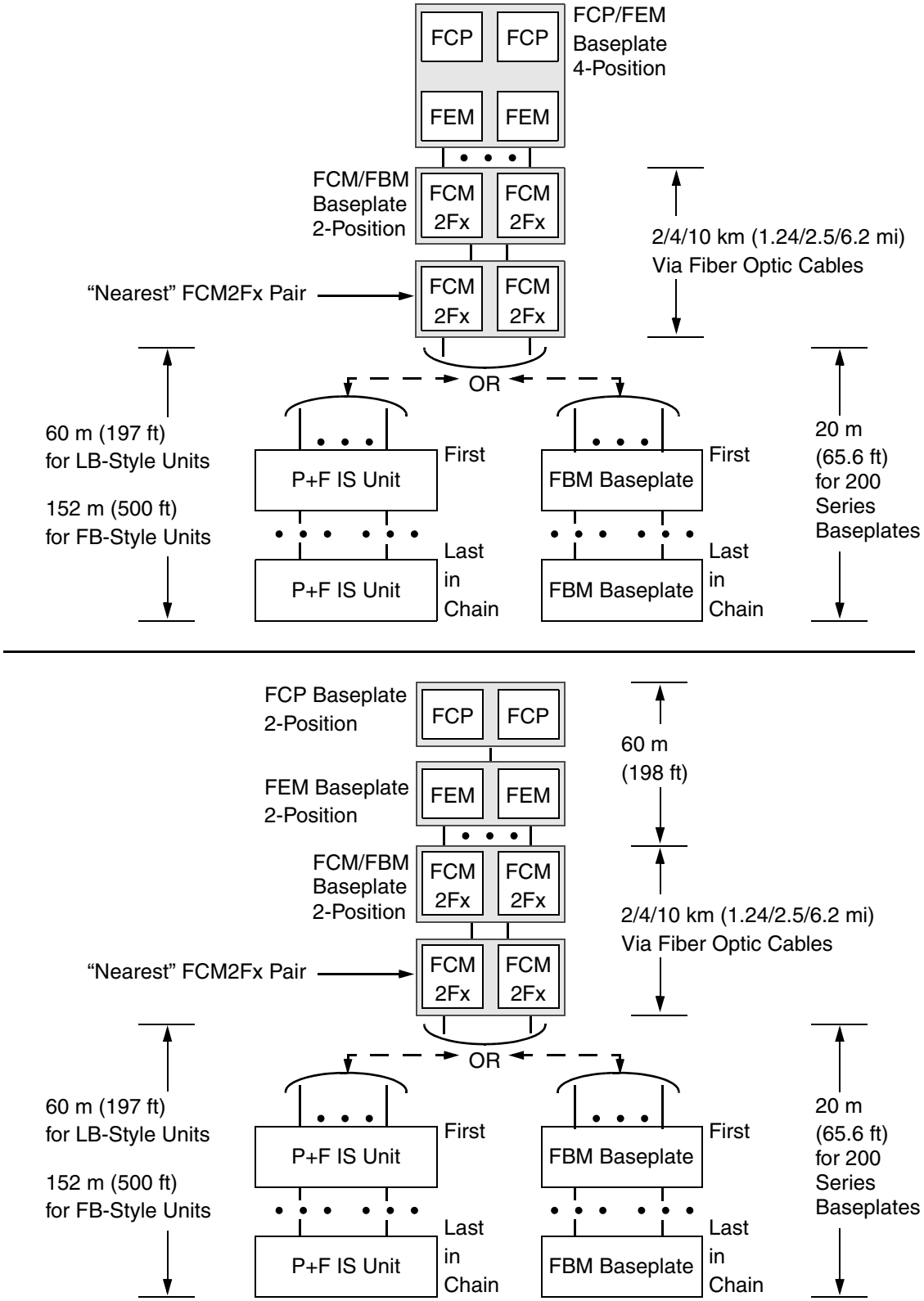


Figure 1-11. Fieldbus Cable Length Restrictions for FCP270, FEM100 and Intrinsically Safe Units with FCM2Fs

For additional fieldbus cabling lengths for Zone 2 applications from the FCP270 or ZCP270 to the ISCM, refer to the section "Communication to 200 Series Fieldbus Modules" in *Field Control Processor 270 (FCP270) User's Guide* (B0700AR) or *Z-Module Control Processor 270 (ZCP270) User's Guide* (B0700AN).

Also refer to Table 3-1 on page 35 for a list of standard fieldbus cables offered by Invensys and their associated lengths.

ISCM Sizing Constraints

Depending on the sizing guidelines, each redundant pair or non-redundant ISCM for Zone 2 (LB-style) applications supports up to 46 intrinsically safe I/O modules, while each redundant pair or non-redundant ISCM for Zone 1 (FB-style) applications supports up to 48 intrinsically safe I/O modules.

Both LB- and FB-style applications support a total of 16 ISCMs per I/A Series control processor (FCP270, ZCP270 or later); a maximum of 204 modules (ISCMs, I/O modules and 200 Series FBMs) is supported per FCP270 and a maximum of 128 modules is supported per ZCP270, provided the maximum CP Fieldbus load and intrinsically safe I/O power supply load is not exceeded.

A single point module will consume the same fieldbus load as a multi-point module. Output modules consume twice the fieldbus load as input modules. The maximum recommended fieldbus load is 75%.

To estimate the fieldbus load for each configuration, refer to *Field Control Processor 270 (FCP270) Sizing Guidelines and Excel Workbook* (B0700AV) or *Z-Module Control Processor 270 (ZCP270) Sizing Guidelines and Excel Workbook* (B0700AW).

The fieldbus loading conditions are described in "IS/IO System Configuration Requirements" on page 4.

⚠ CAUTION

The FCP270 cannot support more than 204 I/O modules, ISCMs and FBMs. Significant operational issues and communication failures may occur if more than 204 modules are configured for this subsystem. Note that redundant ISCMs and redundant FBMs count as three modules; all others count as one.

P+F I/O Module Feature Differences

Be aware of the following differences between the P+F I/O modules and standard FBM types when preparing to configure your I/A Series system.

General Differences

All of the P+F I/O modules have fewer I/O channels than their analogous I/A Series FBM types. Refer to Table 1-4 and Table 1-6, which list the number of channels for each I/O module.

The EEPROM and software versions displayed for the P+F I/O modules are inherited from the ISCM which are most likely to be different than the EEPROM and software versions of the equivalent 200 Series FBMs. For example, at this writing the current version of FBM 201 is 1.40D whereas the version of the ISCM is 2.40. To avoid confusion, the P+F I/O modules display **201i 2.40** to distinguish them from 200 Series FBMs. In addition, the **Hardware Part** field displays a partial P+F model code such as **LB 3x04**. Refer to Figure 5-4 on page 102 which shows this example. Do not perform the "EEPROM update" command on the P+F I/O modules, as doing so will not change their software version and will take the modules off-line for the same time that it would take for the EEPROM update to complete. However, if EEPROM update is invoked, it will do no harm to the ISCM or the I/O module.

If it desired to bring all of the I/O modules on line by the use of the **General Download** pick on the Control Processor's FBM0 Equipment Change Action (available through SMDH or the System Manager), you must first turn all of the ISCMs on-line before selecting this action, or as an alternative, use **General Download** to bring the ISCMs on-line and then invoke the action a second time to bring the I/O modules on-line.

Line Fault Detection and Bad I/O Alarming

Many of the P+F I/O modules have line fault detection, which can indicate any of the following conditions:

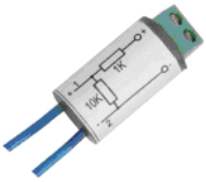
- Analog current input below 0.5 mA or above 22 mA
- Analog output current loop is open
- Digital input open or short circuit
- Digital output open or short circuit
- Thermocouple is burned out
- Thermocouple CJC input is open

Each of these conditions is detected by the I/O module, which turns on a red LED on its front to indicate the condition. In addition, this condition is reported to the I/A Series system by the setting of the BAD I/O bit for that channel. When this bit is set, the following indications can be seen at the I/A Series block and system level:

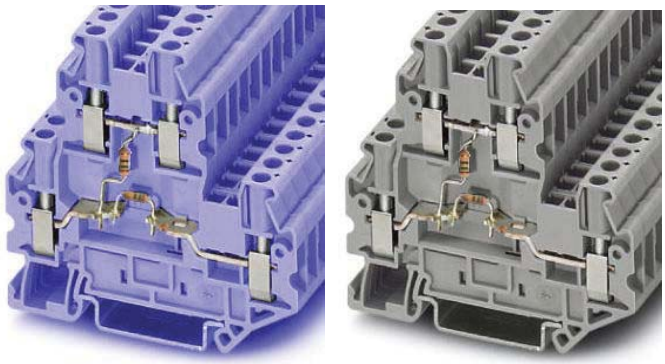
- The I/O point block display (faceplate) highlights the point value in RED, regardless of any block configuration options.
- If the BAO option is configured in the I/O block, the block generates a process alarm and indicates IOBAD on the faceplate.
- If the BADALM parameter 0x01 bit is set in the PRIMARY_ECB for the CP, this causes the fault to generate a system alarm and the FBM icon representing the I/O

card displays a yellow warning condition. In addition, the System Manager or SMDH displays a set of I/O points and indicates BAD for the channel(s) with the fault.

Digital inputs are designed to be used with NAMUR devices and will report BAD I/O if connected to dry contacts. A resistor network (P+F Part Number F-NR-Ex1) is available that will adapt dry contacts for use with these input modules. Refer to the P+F "Technical Note – ISCM Modules with line fault detection" Technical Note.doc 01.09.2010 available from the P+F website *http://www.am.pepperl-fuchs.com/* for further information.



NAMUR Replacement Resistors Model: F-NR-Ex1



IS Terminal Block with NAMUR Replacement Resistors (UKK 5-2R/NAMUR)
Use increased safety terminals for increased safety I/O modules (gray)

Figure 1-12. NAMUR Replacement Resistors

Pulse Count P+F I/O Module Behavior

Be aware that a direction input line fault on the pulse count + direction of rotation P+F I/O modules (Zone 2 environment: LB 1104 F and LB 1104 FL, Zone 1 environment: FB1204 F, FB1204 FL, FB1304 F and FB1304 FL) can cause the modules' counter to reverse direction. This is normal behavior for these I/O modules and does not require correction.

For example, if point 2 for LB 1104 F is set for the counter to count down and an OPEN line fault is created for point 2, the pulse counter will reverse direction and start counting up. The opposite will occur as well; if point 2 for LB 1104 F is set for the counter to count up and an SHORT line fault is created for point 2, the pulse counter will reverse direction and start counting down.

Unlike the standard 200 Series FBM 206, the 1x03 frequency input module does not show a pulse count in the RAWC parameter of the AIN block, and the 1x04 pulse count module does not show a frequency reading in the PNT parameter of the AIN block. These parameters are unused and always remain at zero.

Digital I/O Modules

Digital P+F I/O modules analogous to the I/A Series FBM types 207, 241 and 242 (listed in Table 1-2 on page 6 and Table 1-4 on page 7) do not support:

- ECB6, ECB7 or ECB8
- HPS Sequence of Events (SOE)
- Configurable input filtering or momentary output rates shorter than the BPC of the control processor.

Digital I/O Modules Analogous to FBM241

When connecting a MCIN block to a digital P+F I/O module analogous to FBM241, the module's digital output channel state can be seen in the MCIN block as point 9. An I/A Series FBM241 connected to an MCIN block operates in the same way. If a line fault occurs for the I/O module's output channel, the MCIN block will be marked as BAD; bit 20 of the MCIN block's BLKSTA parameter will be set. The MCIN block's BAD bit is set if any point for the MCIN block is marked as I/O BAD, but this does not affect operation of the two digital inputs.

HART® I/O Modules

The HART® I/O modules' digital values are limited to data from universal commands 3 and 48 as connectable parameters. (Refer to Table 4-9 on page 87 for this list.) Other information can be obtained through a handheld terminal or by using IFDC, FDT or PactWare. The data transfer rate of four channel HART I/O modules is slower since there is only one HART modem for all four channels.

NOTE

It can take up to twenty seconds for DCI blocks connected to a HART device through the ISCM to indicate Out-Of-Service status.
It can take up to 85 seconds for the status of a failed HART device to be reported to the SMON/SMDH applications through the ISCM.

NOTE

It is recommended that you use IFDC with the four-channel HART I/O modules only if you turn off the HART communication for the other three channels on the I/O module before starting IFDC.

Analog Input Modules

The P+F analog input modules do not support configurable integration periods, rate of change alarming, or TDR (Transient Data Recording).

The analog input modules that support line fault detection are set to detect the line fault at 0.5 mA or lower input current so that they may be used with SCI set to 1 for applications where the input must be used below 4 mA. This ensures that a true open circuit line fault will be detected, yet still allows faultless operation down as low as 2.5% of the range. When the SCI is set to 3, the AIN or RIN input block will detect the low input level below -2% (3.92 mA) and the input will be marked BAD by the block.

ISCM Redundancy

Redundant ISCM modules are available to provide continuous availability of the process information coming from the P+F I/O modules even if a failure of one of the ISCM modules should occur. Both ISCM modules maintain a database of the process data read from and written to the modules so that no interruption of the process occurs should the modules switch roles as the result of a failure, removal of one ISCM, or by a user action through the System Management equipment change action.

The hardware design of the HART I/O modules restricts the digital data obtained from HART device only to the master ISCM, whereas the analog current data is available to both ISCM modules. As a result, this digital data is interrupted for a short time after a role switch until the master ISCM can re-establish communication with the HART device. Thus, the ISCM must mark the stale data in the ISCM out of service until fresh data is received by the ISCM that is now the master. The ISCM assumes that all HART devices are available after the role switch in order to avoid unnecessary alarms. After a role switch, HART devices that are failed will go out of alarm until the ISCM has determined once again that they are failed.

When an ISCM is installed in the LB-style or FB-style system base/extension unit which has an active master, the newly installed module must obtain the current database for the ISCM and for each of the I/O modules from the master module through the ISCM communication bus. This synchronization of the database takes some time and varies depending upon the number of modules, the module types and the fieldbus load on the I/A Series system. In heavily loaded systems, this synchronization may take up to five minutes before the ISCM comes back on-line.

This will be indicated in the System Manager or SMDH when the ISCM icon changes from yellow to white, and in the System Monitor log where the message "*warning condition no longer exists*" will be seen.

Power Supply Redundancy for Units in Zone 2 Environments

Two LB 9006 C power supplies are required for each LB-style base and extension unit. Where redundant ISCMs are also installed, a third power supply is required in each unit to support redundancy. The third power supply remains in standby mode to prevent any interruption in power if one of the other LB 9006 C power supplies fails.

2. Quick-Start Example

This chapter provides an example configuration, which provides most of the information you need to get your I/A Series system with Intrinsically Safe Communications Modules (ISCM) integrated with the P+F system up and running in the shortest possible time.

A typical sequence for installing and configuring the I/A Series system to integrate with a P+F system through ISCMs is outlined in Figure 2-1. Following this diagram is the procedure, whose steps are keyed to the diagram.

— NOTE

The following assumes that the individual P+F I/O modules have been configured for the required process control operations.

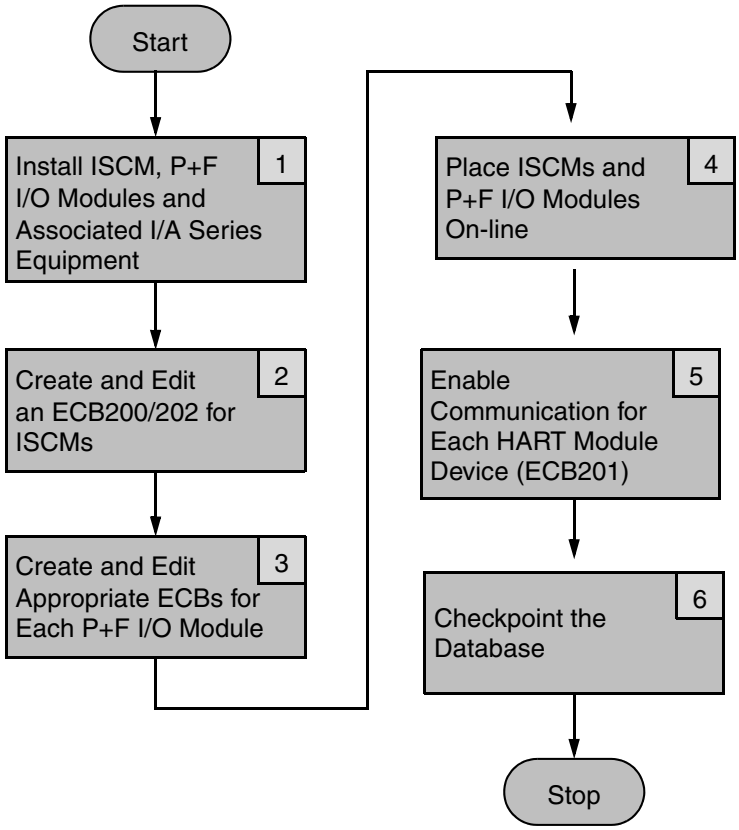


Figure 2-1. Typical I/A Series System/P+F System Integration Process

— NOTE

This following overview of procedures assumes that you are familiar with I/A Series system concepts and P+F system concepts. Appropriate documents and sections herein are referenced in each step.

1. **Install the ISCMs, P+F I/O modules and any required hardware or cabling in the I/A Series system and P+F system.**
   a. Install any major elements of the I/A Series system equipment as described in the documentation included with the equipment.
   b. Perform the system definition by reading Chapter 4 “Configuration Information”.
   c. Install the I/A Series system software by referring to Hardware and Software Specific Instructions document that came with your workstation.
   d. Install the ISCMs, I/O modules and the associated base/extension units, as described in Chapter 3 “Installing the ISCM, P+F I/O Modules and Base/Extension Units” of this user guide. For the FCM100E(s) and cabling, refer to the *DIN Rail Mounted FBM Subsystem User’s Guide* (B0400FA). For the I/A Series control processors, refer to their associated user guide.
2. **Create and edit ECB200 or ECB202 for the ISCM.**
   See “ISCM Configuration” on page 44.
3. **Create and edit the appropriate ECBs and I/O blocks for each P+F I/O module.**
   See “Intrinsically Safe I/O Module Configuration” on page 57.
4. **Place ISCMs and P+F I/O modules on-line via SMDH or the System Manager.**
   See Chapter 5 “System Management” and refer to the appropriate manual:
   - *System Manager* (B0750AP)
   - *System Management Displays* (B0193JC)
   - *Process Operations and Displays* (B0700BN)
5. **Enable communication with each HART module (ECB201) via SMDH or the System Manager.**
   Refer to the items listed in the previous step.
6. **Checkpoint the database.**
   For details, refer to *System Manager* (B0750AP), *System Management Displays* (B0193JC), or *Integrated Control Configurator* (B0193AV).

3. Installing the ISCM, P+F I/O Modules and Base/Extension Units

This chapter provides installation and cabling information for the ISCM, P+F I/O modules and the ISCM base, redundancy and extension units.

Overview

The ISCM self-configures itself on power-up by reading the identity of the attached I/O modules in the base/extension units. Then it sets up the data structures in memory to emulate the appropriate FBM database for each I/O module and populates a table with the letterbug of each I/O module. If any I/O modules are removed or added during this operation, the ISCM updates its internal configuration and databases so that the I/A Series system is alerted of this event.

Dual width I/O modules communicate all of their available data through a single letterbug, defined by the leftmost slot position where it is installed.

The ISCM may be configured as single or redundant. Communication between the two modules in the redundant configuration is accomplished through the communication bus on the base/extension unit in which the modules are installed.

System Definition

System Definition identifies the I/A Series system components, system software required by each component, the system component letterbugs, and other system characteristics for correctly loading system software and identifying the system software objects. The letterbug is an alphanumeric string that the user defines to identify a station or particular module in an I/A Series control system.

System Definition is initially performed prior to installation of the system equipment, and it is updated with any hardware/software system changes. Reports produced by InFusion View and System Definition (SysDEF) software define the system network and provide information that can be used in conjunction with equipment installation.

For a step-by-step procedure for defining an InFusion system configuration using the InFusion Engineering environment (IEE), refer to *InFusion Deployment Guide, Control Edition* (B0750BA).

For a step-by-step procedure for defining an I/A Series system configuration using the System Definition (SysDEF) software, refer to *System Definition: A Step-By-Step Procedure* (B0193WQ).

ZCP270 Usage Restrictions

The ISCM can be used with the ZCP270 as long as the following restrictions are followed:

- A separate Fieldbus Communications Module (or FCM pair) must be used with each ISCM on the HDLC Fieldbus between the ISCM and the ZCP270. The FCM or FCM pair is tied to the ISCM, and the first four letterbug characters in the ISCM must be the same as the first four letterbug characters of the associated FCM or FCM pair.

- If the ZCP270 also supports 200 Series FBMs as well as the P+F I/O modules, these 200 Series FBMs must be connected to another FCM (or FCM pair) to avoid letterbug addressing conflicts.

Installation Standards and Safety Advice

Before installing ISCMs and P+F I/O modules into the ISCM base/extension unit, refer to the following documents for safety advice regarding mounting any modules into this unit and applying cables to the modules and base/extension units:

- *FB Remote I/O Bus System Hardware*
- *LB Remote I/O Bus System Hardware*

To locate these documents on Pepperl+Fuchs' website, refer to "P+F Intrinsically Safe I/O Modules Overview Specifications" on page xv.

Module Addressing

ISCMs and intrinsically safe I/O modules are identified to the I/A Series system software by means of a unique, 6-character string called a letterbug. The letterbug string for a particular ISCM or I/O module is established from three factors:

- The first 3 characters are user defined with the FCP/ZCP's configurator application, such as SysDef. These characters are generally unrestricted for the FCP, but for the ZCP, they must match the FCM to which the ISCMs are to be connected. Also, the same first 3 characters of the FCP/ZCP's letterbug should not be used.
  The first 3 letterbug characters are defined by the process engineer during the FCP configuration and the ISCM will accept any combination of alphanumeric characters 0 to 9 and A to Z and any supported special characters as a match in those positions.
- The fourth letterbug character will indicate the ISCM number determined by the rotary switch position from 0 to 9 and A to F, on the ISCM letterbug module thereby allowing up to 16 ISCMs per FCP/ZCP.
  The fifth letterbug must be "**M**" and the sixth letterbug must be "**1**" for single ISCMs or "**A**" for the redundant pair.
- The first four letterbugs will be the same for each of the I/O modules connected to the ISCM as defined by the ZCP/FCP configuration and the switch setting.
- The fifth and sixth characters will identify the slot position 01 to 48.
  Dual width I/O modules communicate all of their available data through a single letterbug, defined by the leftmost slot position where installed on the unit.

Using a ZCP270 and FCMs will limit the number of ISCMs to one per FCM or FCM pair since the fourth letterbug character must be the same as that of the FCM. The FCM letterbugs must then be xxx000 through xxxF00 to match the fourth character of the ISCM connected to the FCM. Standard FBMs cannot be hosted by any FCM that also hosts the ISCM. The last two characters of the FCM letterbug should be '00'. The first four FCM characters must not match the first four characters of the ZCP's letterbug.

The ISCM can be used with the ZCP270 as long as the following restrictions are followed:

- A separate Fieldbus Communications Module (or FCM pair) must be used with each ISCM on the HDLC Fieldbus between the ISCM and the ZCP270. The FCM or FCM pair is tied to the ISCM, as the fourth letterbug character in the ISCM must be

the same as the fourth letterbug character. in the associated FCM or FCM pair. This requirement means that the character selected for the FCM letterbug's fourth character must be 0-9 or A-F.

- If the ZCP270 also supports 200 Series FBMs as well as the P+F I/O modules, these 200 Series FBMs must be connected to another FCM (or FCM pair) to avoid letterbug addressing conflicts.

Setting the ISCM Letterbug

Select the fourth character of the ISCM letterbug by setting the rotary switch on the letterbug module (P0924GV), shown in Figure 3-1. This character must match the fourth character of the FCM, if attached to an FCM. This module is plugged into the left-most receptacle on the front of the ISCM, and then screwed down to hold it in place.

⚠ CAUTION

When installing ISCMs in an LB-style or FB-style system, it is critical that the ISCM letterbug switch settings are unique for a CP and identical to each other for redundant ISCMs. Otherwise, the ISCMs and I/O modules may not function correctly in the system.

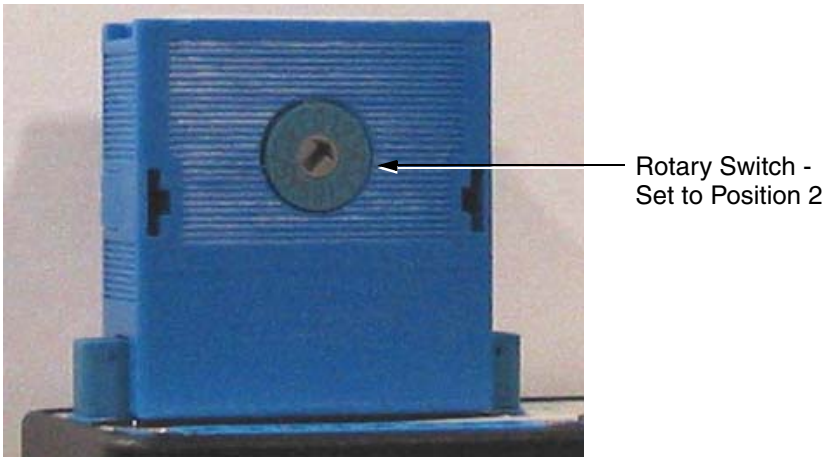


Figure 3-1. Letterbug Module (P0924GV)

Installation and Cabling for Intrinsically Safe I/O Subsystems

NOTE

P+F intrinsically safe equipment is powered from two P+F 24 V dc power supplies that accept 115/230 V ac inputs included with their enclosures. P+F supplies the mains power supplies for the LB-style units, and the FB-style units connect directly to the mains supply. The Invensys control processors and standard 200 Series FBMs must be powered by Invensys power supplies, separate from the P+F equipment. Refer to *DIN Rail Mounted FBM Subsystem User's Guide* (B0400FA) for details about the Invensys power supplies.

NOTE

Invensys 115/230 V power supplies may be used to power LB9006C power supplies from the mains instead of using P+F's own power converters. One Invensys power supply supports a maximum of ten (10) LB9006C power supplies unless power is diverted to other consumers.

Zone 2 (LB-Style) Equipment Installation

To install the intrinsically safe I/O modules supported by the ISCM in Zone 2 environments (the LB-style), perform the following:

- Install the ISCM base unit for Zone 2 (LB-style) applications to a DIN rail on a mounting surface or an enclosure.
- Connect one or two power cables per base unit to optionally redundant 24 V dc power supplies using the X01 and X02 connectors.

NOTE

Power cabling connections are discussed in the section "Installation" in *LB Remote I/O Bus System Hardware*

- Connect standard HDLC cable from main ISCM base unit to the FCP/FCM100 baseplate using one 9-pin D connector on left end of the main ISCM base unit.
- Interconnect any extension baseplates to the ISCM base unit using the standard HDLC cables.
- Install a standard HDLC terminator on last ISCM base unit using one 9-pin D connector on left end of the ISCM base unit.

NOTE

Be aware of the 60 m (197 ft) limit on standard HDLC cabling. If longer fieldbus cable runs are needed for a particular installation, FCM2F2, FCM2F4, or FCM2F10 modules can be used to extend the fieldbus over 2, 4, or 10 km fiber optic cables. Refer to *DIN Rail Mounted FBM Subsystem User's Guide* (B0400FA) for details.

- Boost power is required for the digital output I/O modules, LB 6110 A through LB 6115 ES (see Table 1-4 on page 7). Connect 24 V dc boost power to these modules for ISCM main and extension units to the X40 connector.
- Configure the shutdown input switch and connect wiring to the shutdown switch or voltage source if needed for main and extension ISCM units to the X03 connector.
- Connect the extension cable included with the extension unit from the ISCM base unit to the ISCM extension unit using the 15 pin D connectors at the left ends of the units.
- Install the LB-style power supplies, ISCM(s) and the I/O modules as discussed in "Installing ISCMs and P+F I/O Modules" on page 37.
- Install the I/O wiring on each of the I/O modules' front connector(s).

Use the HDLC shielded twisted-pair Module Fieldbus cables, available in the lengths shown in Table 3-1.

Table 3-1. HDLC Shielded Twisted-Pair Module Fieldbus Cables

Part Number	Length
P0916ND	0.25 m (10 in)
P0916MZ	1 m (3.3 ft)
P0916NC	3 m (9.9 ft)
P0916NB	5 m (16.5 ft)
P0916NA	10 m (33 ft)
P0916UH	20 m (66 ft)
P0916UJ	30 m (99 ft)
P0916UK	60 m (198 ft)

Zone 1 (FB-Style) Equipment Installation

To install the intrinsically safe I/O modules supported by the ISCM in Zone 1 environments (the FB-style), perform the following, using the cables supplied with the base/extension units:

- Install the FB (Zone 1) enclosures on a mounting surface or in a cabinet.

NOTE

Installation and power cabling connections are discussed in *FB Remote I/O Bus System Hardware*.
Be aware that Zone 1 power and bus cables must conform to increased safety requirements. Also consider the voltage drop which may occur across long power cables. Ensure that the remaining voltage does not drop below the minimum required for the power supply.

- Connect the FB 9271 cable from the ISCM redundancy unit to the ISCM base unit (see Table 3-2 on page 39).
- Connect FB 9272 cable from the ISCM base unit to the ISCM extension unit (see Table 3-5 on page 40).
- Connect FB 9273 cable from the ISCM redundancy unit to the ISCM extension unit (see Table 3-4 on page 39).

NOTE

The FB 9283 cable supplied with the FB units is not used with the ISCM.

- Install the HDLC cables from the FCP/FCM to the ISCM redundancy unit (see Table 3-3 on page 39). See Figure 3-2 for cable details.

NOTE

Boost power is required for the digital output I/O modules, FB 6210 B through FB 6215 ES (see Table 1-6 on page 11). These modules feature front end Ex-e connections in addition to the intrinsically safe plug-in connectors. The Ex-e connections must be connected to 24 V dc power for the modules to operate correctly.

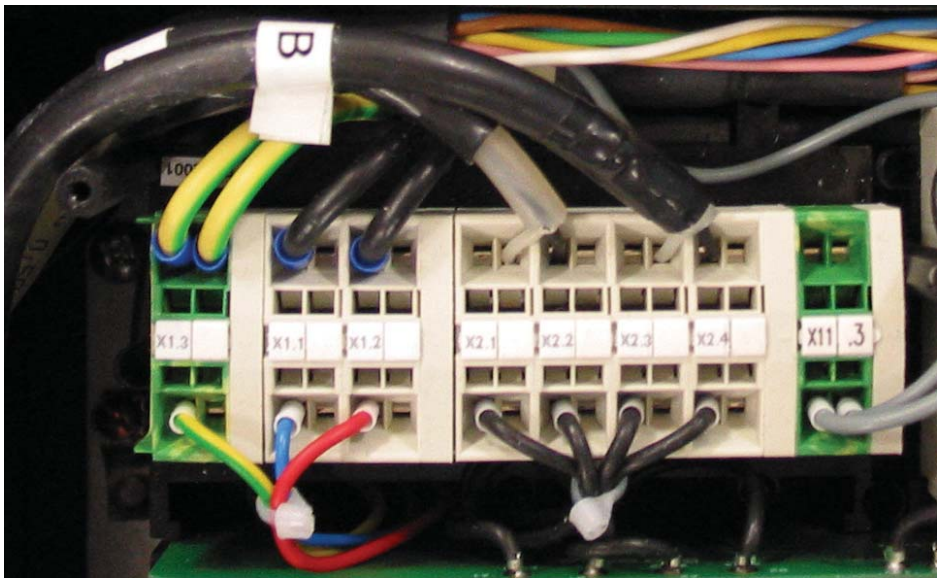


Figure 3-2. HDLC Cable Connections to Last FB ISCM Base/Redundancy Unit

- Install the HDLC cables (2 m (6.6 ft)) from the ISCM redundancy unit to the ISCM base unit (see Table 3-3 on page 39).
- Install the FB 9293 F termination module in the base or redundancy unit which is physically at the end of the HDLC cable run. The module is installed adjacent to the ISCM in the slot labeled **Termination**.

NOTE

Be aware of the 152 m(500 ft) limit on HDLC cabling from end-to-end when using high-quality twinaxial shielded cable. If longer fieldbus cable runs are needed for a particular installation, FCM2F2, FCM2F4, or FCM2F10 modules installed in a nearby Zone 2 area can be used to extend the fieldbus over 2, 4, or 10 km fiber optic cables. Refer to *DIN Rail Mounted FBM Subsystem User's Guide* (B0400FA) for details.

- Install the power cable to the ISCM redundancy unit.
- Install the power cable to the ISCM base unit.
- Install two power cables to the ISCM extension unit.
- If needed, connect the shutdown wiring and/or boost power to the ISCM main and extension units.
- Install the FB-style power supplies, ISCM(s) and the I/O modules as discussed in "Installing ISCMs and P+F I/O Modules" on page 37.
- Install the I/O wiring to each of the I/O module front connectors.

Installing ISCMs and P+F I/O Modules

WARNING

For safety reasons, always consider the possible impact on plant operations before removing an ISCM or an I/O module from a base/extension unit in an active control system.

To install ISCMs and supported P+F I/O modules into the appropriate ISCM base/extension unit, refer to the following:

- For Zone 1 environments, the section "Insertion / Swapping" in *FB Remote I/O Bus System Hardware*
- For Zone 2 environments, the section "Inserting and removing I/O modules, com units, and power supplies" in *LB Remote I/O Bus System Hardware*

If replacing an existing ISCM, update the ISCM software image in the new module with the same image as the module you are replacing.

Intrinsically Safe I/O Modules (Zone 1 Environments) Interconnection Cables for ISCM

The intrinsically safe I/O modules for Zone 1 environments (FB-style modules) require special cables to connect to the ISCM base/extension units. The following tables describe the functions of the wires in each cable. Note that the black and purple wires of the FB 9271 cable are not connected at either end. These wires should be cut off or insulated with electrical tape to avoid contact with anything on either end.

— NOTE

Table 3-2 and Table 3-3 below intentionally differ from the wiring tables shown in the FB operating instructions for the FB system, since the HDLC-B bus connections are used for the service bus in FB systems that do not use the ISCM communication units. The service bus for the ISCM is connected to the right-most receptacle on the front of the ISCM and is used for manufacturing diagnostic purposes only.

Table 3-2. FB 9271 - Redundancy to ISCM Base Unit Cable

Color	Function		Redundancy	Base
Red / Blue	12V		X4.7	X4.7
Brown / Green	5V		X4.1	X4.1
Brown / Yellow	Pgs2		X4.6	X4.6
Pink	s-sel1		X4.4	X4.4
Blue	s-sel0		X4.5	X4.5
Green	s-ctrl		X4.3	X4.3
White	s-dat		X4.2	X4.2
Yellow	GND	Double farrel	X4.8	X4.8
Brown	GND	Double farrel	X4.8	X4.8
Gray	PE	Green/Yellow Connector	X1.3	X1.3

Table 3-3. P0170GF/GG - HDLC Twinaxial Cable

Function		Redundancy	Base
Bus A-	HDLC-A	X2.1	X2.1
Bus A+	HDLC-A	X2.2	X2.2
Bus B-	HDLC-B	X2.3	X2.3
Bus B+	HDLC-B	X2.4	X2.4

Table 3-4. FB 9273 - Redundancy to ISCM Extension Unit Cable

Color	Function		Redundancy	Extension
Pink	s-sel3		X3.4	X4.4
Blue	s-sel2		X3.5	X4.5
Green	s-ctrl		X3.7	X4.7
White	s-dat		X3.6	X4.6
Yellow	GND	Double farrel	X3.8	X4.8
Brown	GND	Double farrel	X3.8	X4.8
Gray	PE	Green/Yellow Connector	X1.3	X1.3

Table 3-5. FB 9272 - Base to ISCM Extension Unit Cable

Color	Function		Base	Extension
Pink	p-sel3		X3.8	X3.8
Blue	p-sel2		X3.7	X3.7
Green	p-ctrl		X3.5	X3.5
White	p-dat		X3.6	X3.6
Yellow	GND	Double farrel	X3.4	X3.4
Brown	GND	Double farrel	X3.4	X3.4
Gray	PE	Green/Yellow Connector	X1.3	X1.3

Refer to the *Field Control Processor 270 (FCP270) User's Guide* (B0700AR) for cabling information for the FCP270 or *Z-Module Control Processor 270 (ZCP270) User's Guide* (B0700AN) for cabling information for the ZCP270 and FCM100E/Et.

4. Configuration Information

This chapter provides system configuration information (System Definition) and control configuration information.

Overview

In general, "configuration" refers to the act of specifying to the I/A Series system software the types of hardware and software modules that comprise the system, and the control blocks that will be used in the control scheme. Prior to performing configuration procedures, you are encouraged to develop I/O signal lists. You should develop loop control schemes and loop drawings to document the control scheme. From the signal lists and loop drawings, you can determine the type and quantity of equipment required for your control scheme.

System Definition

Your system or control configurator application is used to identify the I/A Series system components, system software required by each component, the system component letterbugs, and other system characteristics for correctly loading system software and identifying the system software objects. System definition with your system configurator produces a Commit disk, which is required for software installation and, therefore, must be completed before software installation. It is initially performed prior to installation of the system equipment, and it is updated with any hardware/software system changes. Reports produced by the system or control configurator define the network of the system and provide information that can be used in conjunction with equipment installation. In the future, if changes are made to the initial hardware layout, the system definition database must be updated to reflect these changes.

The ISCM and its associated I/O modules may be configured from the following configurators:

- InFusion Engineering Environment (IEE)
- SysDef
- ICC
- ICCAPI

Using the configurator, you define the type and quantity of control processors and associated ISCMs and FBM types (for the P+F I/O modules), their letterbugs, and the software (for example, digital input, or analog output) for the FBMs.

NOTE

For ZCP270 systems, the FCM letterbug is defined during System Definition and cannot be changed later. This means that any FCM that will host an ISCM must have its fourth letterbug character defined as 0-9 or A-F. FCMs that host 200 Series FBMs may use any characters in the fourth position.

System Definition Procedure

To perform system definition, configure the I/A Series system as described in the corresponding document provided with your system configurator.

After you have completed system definition, install the system software. Refer to the appropriate *Hardware and Software Specific Instructions* for your workstation.

System Configuration

When you have defined and installed the ISCM, you are ready to configure your control system and download the configuration to the ISCM. System configuration comprises designing your control strategy loop diagrams and configuring the compounds and control blocks for these loops, and downloading the developed control database to the appropriate FCP270 or ZCP270. This control database consists of configuration data for the compounds and associated control blocks, including Equipment Control Blocks (ECBs) required for the FBMs, the control processors and the ISCM.

As a compound/block editor, the Invensys configurators provide compound or block building templates along with a full range of editing functions.

In general, you create a compound in which to locate control blocks for a specific control strategy, for example, the blocks required to control the outlet temperature of a heat exchanger. Then, you create the blocks required for implementing the control strategy.

For each ISCM or I/O module, you create a specific ECB which serves as a “holding place” for the FBM data and status information. The primary ECB for the FCP270/ZCP270 control station is automatically created by the system configurator.

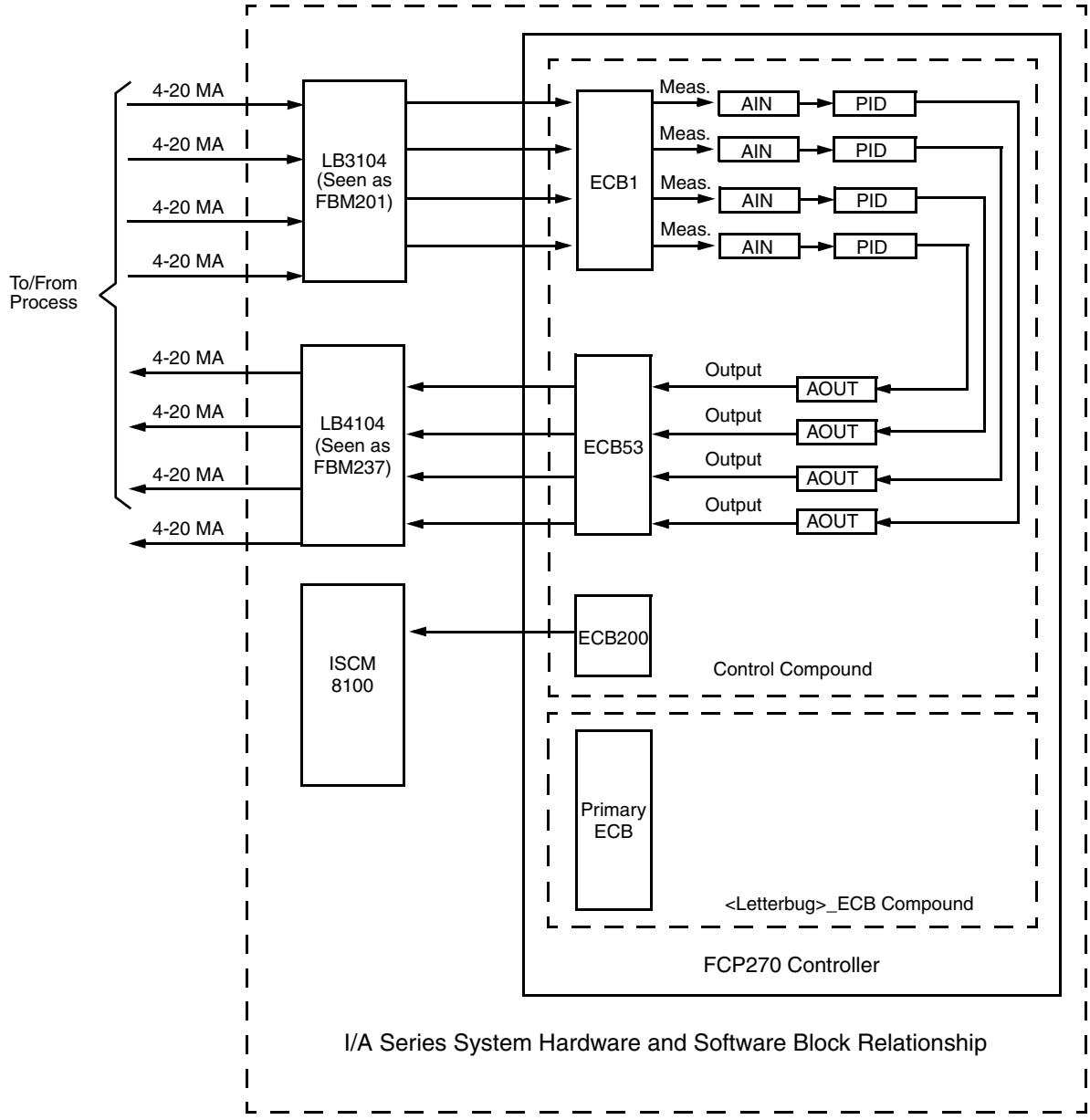
The ECBs provide the software interface between the I/O control blocks and the FBMs. Actual control of the process is performed by compounds, consisting of control blocks, which you configure. Figure 4-1 shows a typical application of control blocks. (Be aware of the limit of 204 or 128 modules for this subsystem.)

Refer to “Integrated Control Configuration” in *DIN Rail Mounted FBM Subsystem User’s Guide* (B0400FA), and the “Configuration Information” chapters of *Field Control Processor 270 (FCP270) User’s Guide* (B0700AR) or *Z-Module Control Processor 270 (ZCP270) User’s Guide* (B0700AN) for instructions on performing system configuration.

If connecting to a ZCP270, refer to “FCM100Et and FCM100E Configuration” in the B0400FA manual to configure the FCM100E modules.

NOTE

When configuring ECB200 for use in with the Intrinsically Safe I/O Subsystem, if the System Options (SYSOPT) parameter is used and it is configured as a Hex value, only high bytes are used on hardware types (HWTYPE) 214, 215 and 250. For other hardware types, only low bytes are considered.



Notes:
1. For ECB parameters definitions and ECB to FBM assignments, refer to *Integrated Control Block Descriptions* (B0193AX).
2. The Primary ECB is automatically assigned to a compound named <Letterbug>_ECB, for example, if an FCP letterbug is H51FCP, the compound name is H51FCP_ECB. The ECBs for the ISCM and the I/O modules may be placed in this compound or in the control compound as shown.

Figure 4-1. Typical Control Scheme Using an FCP270 and P+F IS/IO Modules

ISCM Configuration

The ISCM is configured using ECB200 for non-redundant ISCMs and ECB202 for redundant ISCMs. The letterbug of the ISCM is defined by all of the following rules:

- In FCP270 systems, the first 3 characters are user defined ("***xxx***" in Table 4-1 below).
- In ZCP270 systems, the first 4 characters must match the first four characters of the FCM100E/Et connected to the ISCM or ISCM pair ("***xxxn***" in Table 4-1 below).
- The fourth character of the letterbug must match the ISCM selector switch setting of 0 to 9 or A to F ("**n**" in Table 4-1 below).
- The fifth and sixth letterbugs must be "**M1**" for non-redundant ISCMs or "**MA**" for redundant ISCMs as shown in Table 4-1.

The I/A Series and InFusion systems offers a wide range of control blocks, providing solutions for a broad spectrum of process control applications. For details on the selection and usage of control blocks, refer to *Integrated Control Block Descriptions* (B0193AX).

Table 4-1 lists the appropriate Equipment Control Blocks (ECBs) for use in conjunction with the ISCM modules.

Table 4-1. I/A Series Blocks for ISCMs

P+F Model No.	Description	Letterbug	Hardware Type	ECB	Software Type	I/O Block
ISCM8100	Intrinsically Safe Communication Module for Zone 2 applications (LB-style), non-redundant	*xxx*nM1	250	200	250	none
ISCM8200	Intrinsically Safe Communication Module for Zone 1 applications (FB-style), non-redundant	*xxx*nM1	250	200	250	none
ISCM8100	Intrinsically Safe Communication Module for Zone 2 applications (LB-style), redundant	*xxx*nMA	250	202	250	none
ISCM8200	Intrinsically Safe Communication Module for Zone 1 applications (FB-style), redundant	*xxx*nMA	250	202	250	none

InFusion Configuration Screens for Single ISCM

The following figures provide examples of how to configure ECBs for a single ISCM in the InFusion Engineering Environment (IEE). For details on performing this task in InFusion, refer to *InFusion Block Configurator, Control Edition* (B0750AH).

Figures for configuring ECBs for a single ISCM in ICC are available in "ICC Configuration Screens for ISCM" on page 151.

Figure 4-2 shows how to create a new ECB200 for a single ISCM.

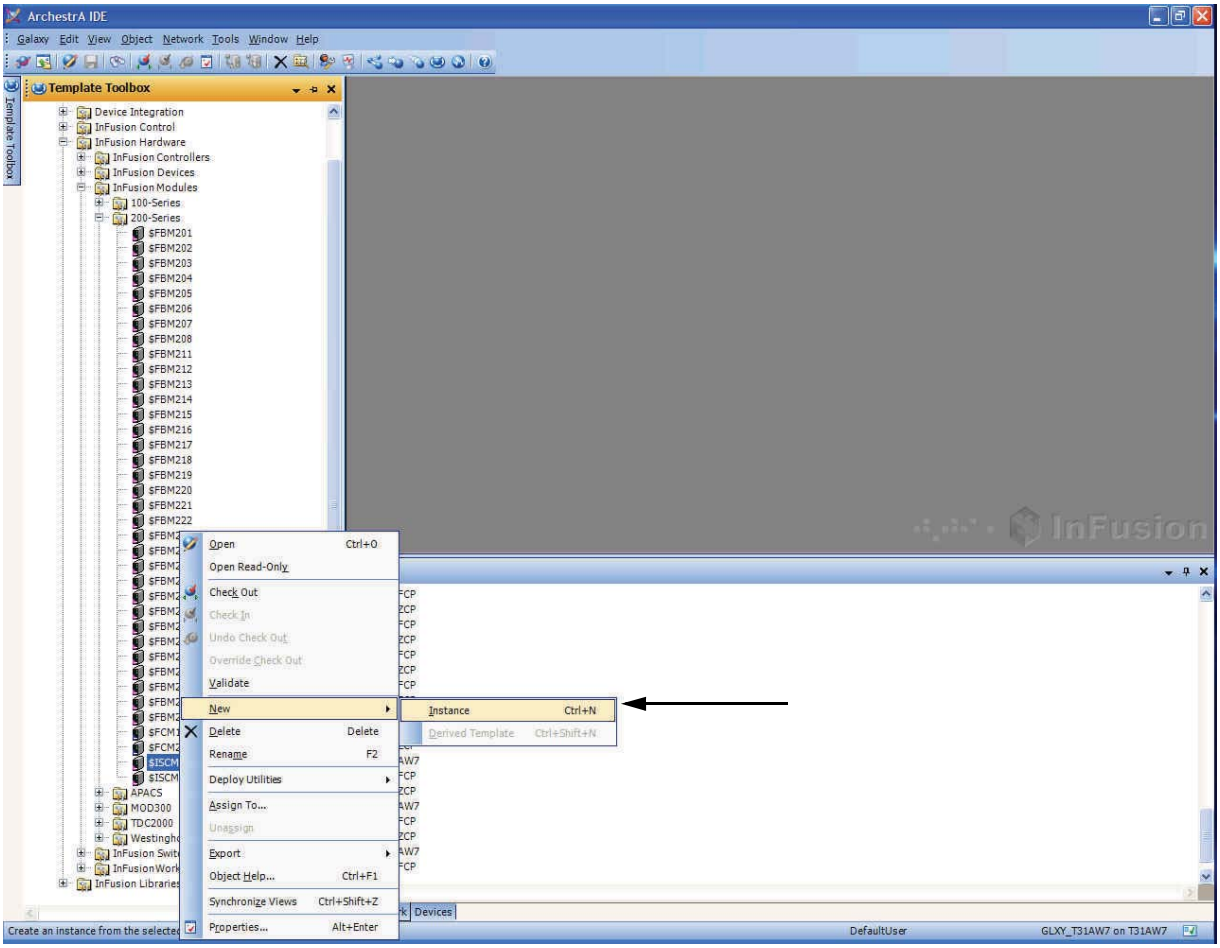


Figure 4-2. Creating a New ECB200 for a Single ISCM in IEE (Example)

Figure 4-3 shows how to rename an ECB200 for a single ISCM.

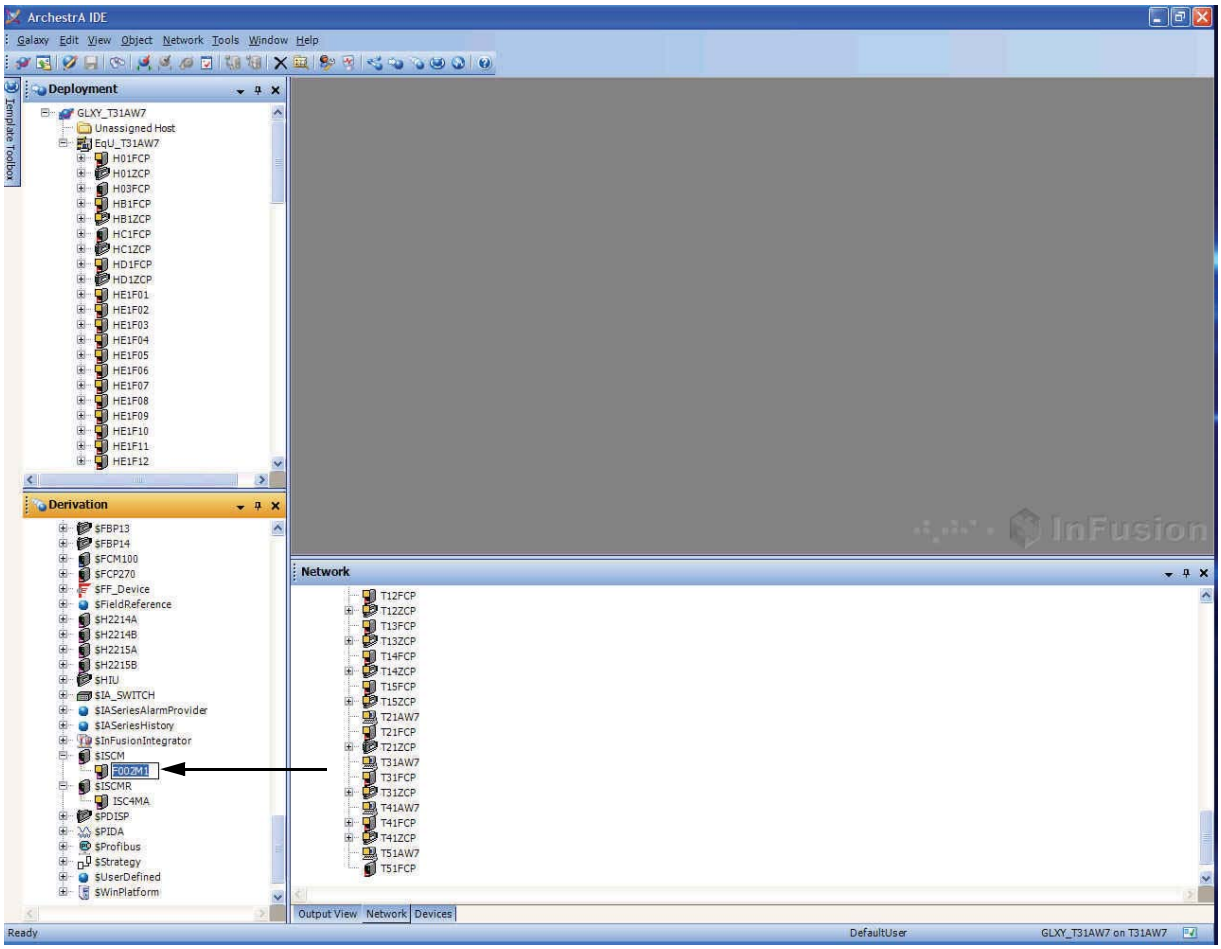


Figure 4-3. Renaming an ECB200 for a Single ISCM in IEE (Example)

Figure 4-4 shows how to assign an ECB200 for a single ISCM to an FCP270 by a drag-and-drop operation.

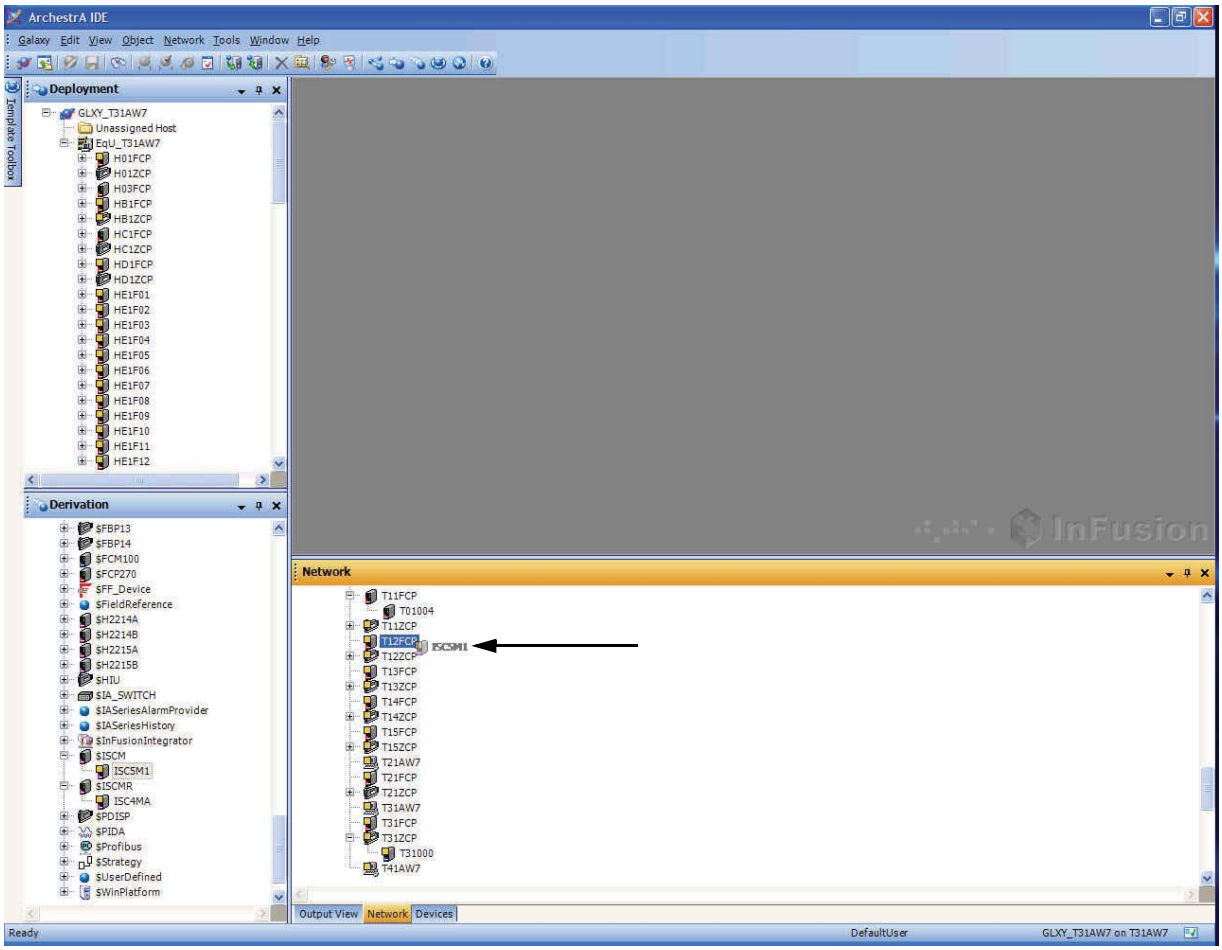


Figure 4-4. Assign an ECB200 for a Single ISCM to a FCP270 (via Drag/Drop) in IEE (Example)

Figure 4-5 shows the single ISCM assigned to an FCP270 in the IEE's Network View.

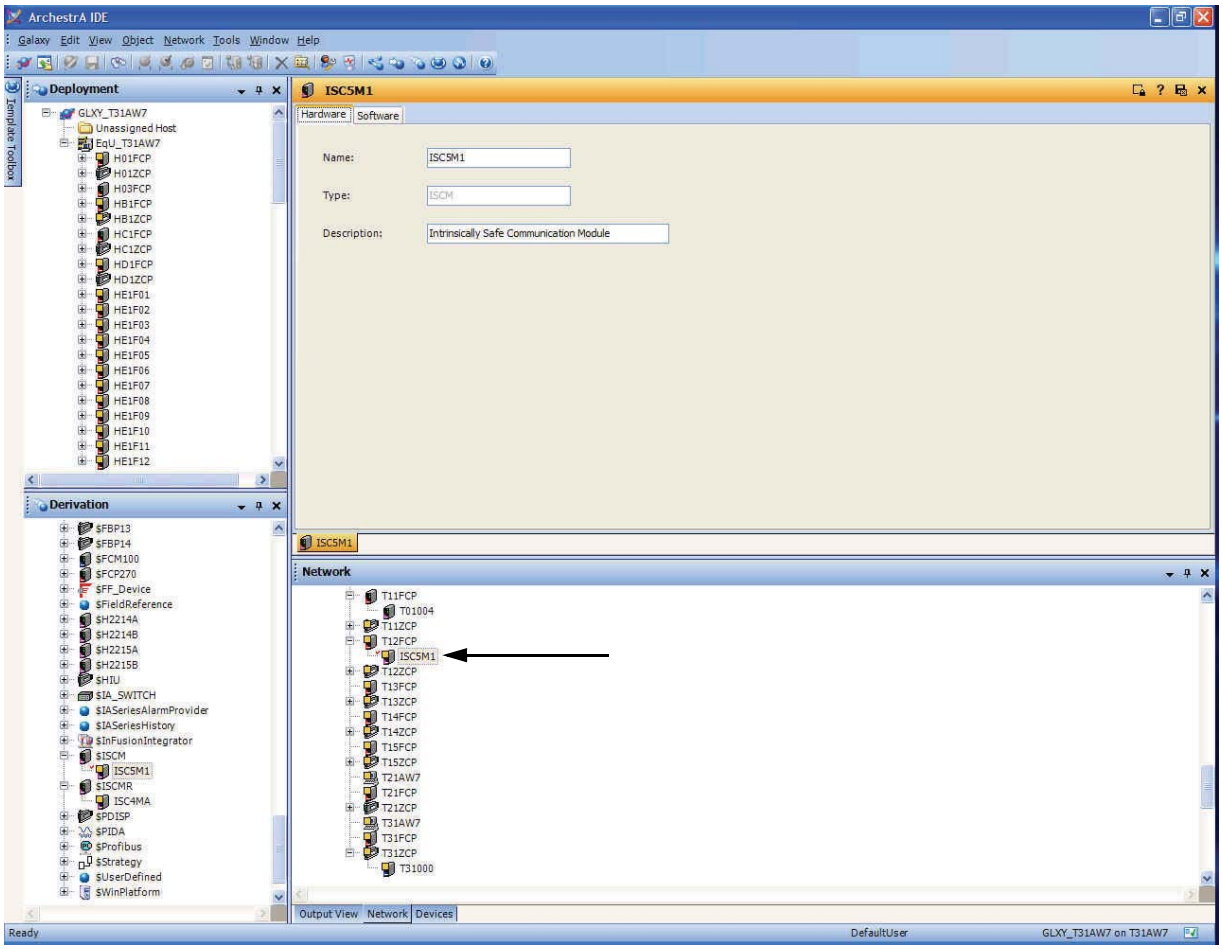


Figure 4-5. Single ISCM Assigned to a FCP270 in IEE Network View (Example)

Figure 4-6 shows the Deployment View, General tab, for an ECB200 for a single ISCM, which allows you to configure several attributes of the ECB200.

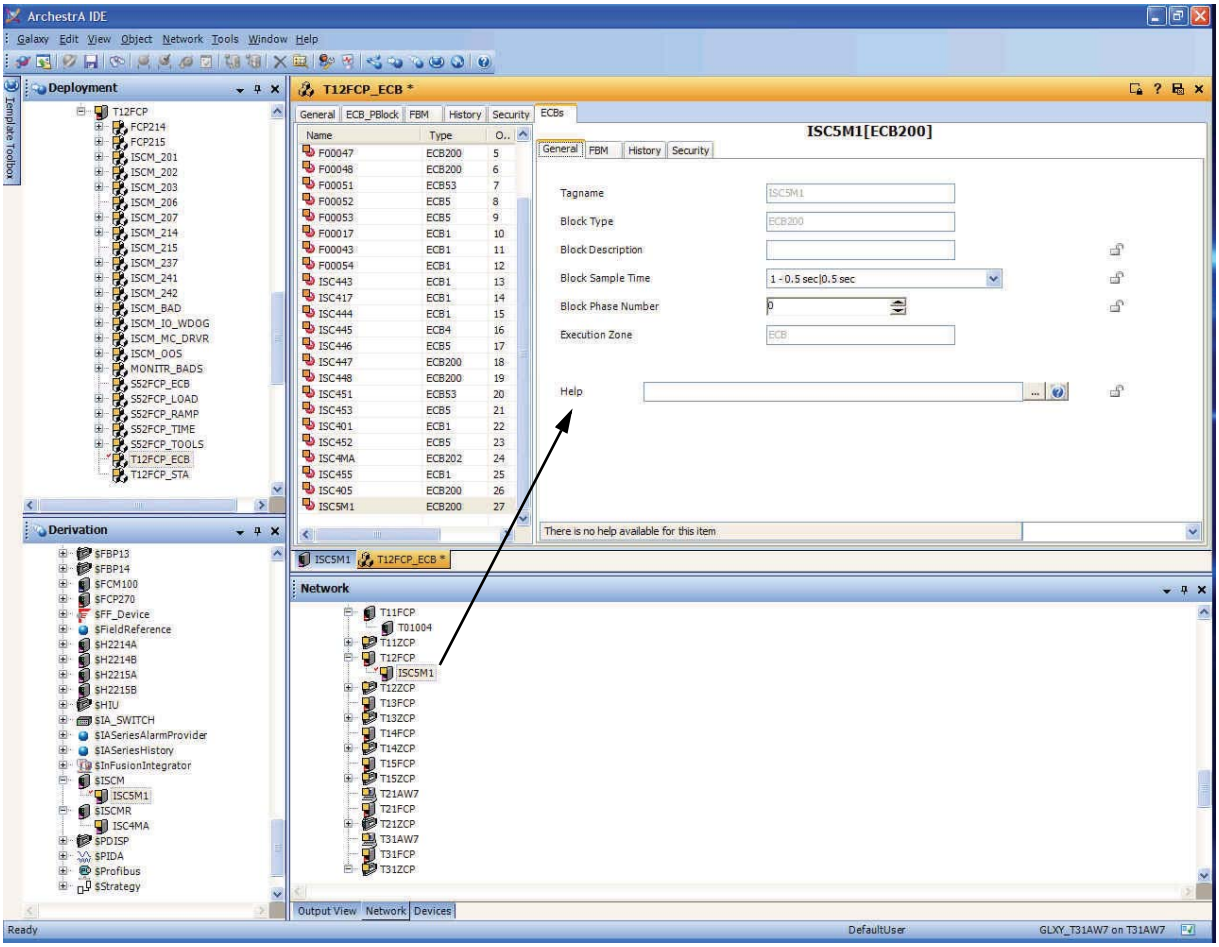


Figure 4-6. Configuring ECB200 for Single ISCM in IEE Deployment View, General Tab (Example)

Figure 4-7 shows the Deployment View, FBM tab, for an ECB200 for a single ISCM, which allows you to configure several attributes of the ECB200.

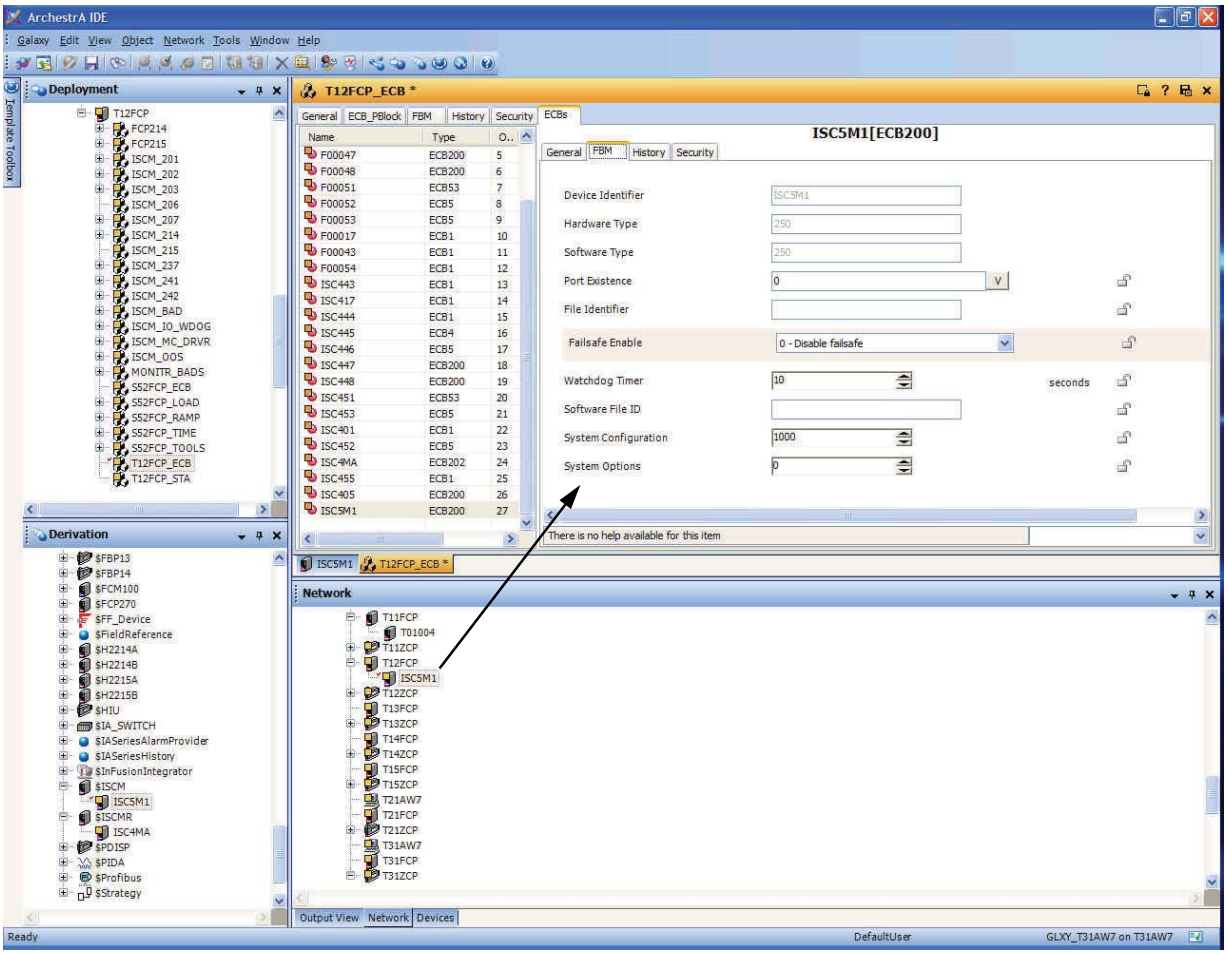


Figure 4-7. Configuring ECB200 for Single ISCM in IEE Deployment View, FBM Tab (Example)

InFusion Configuration Screens for Redundant ISCM

The following figures provide examples of how to configure ECBs for a redundant ISCM in the InFusion Engineering Environment (IEE). For details on performing this task in InFusion, refer to *InFusion Block Configurator, Control Edition* (B0750AH).

Figures for configuring ECBs for a redundant ISCM in ICC are available in “ICC Configuration Screens for ISCM” on page 151.

Figure 4-8 shows how to create a new ECB202 for a redundant ISCM.

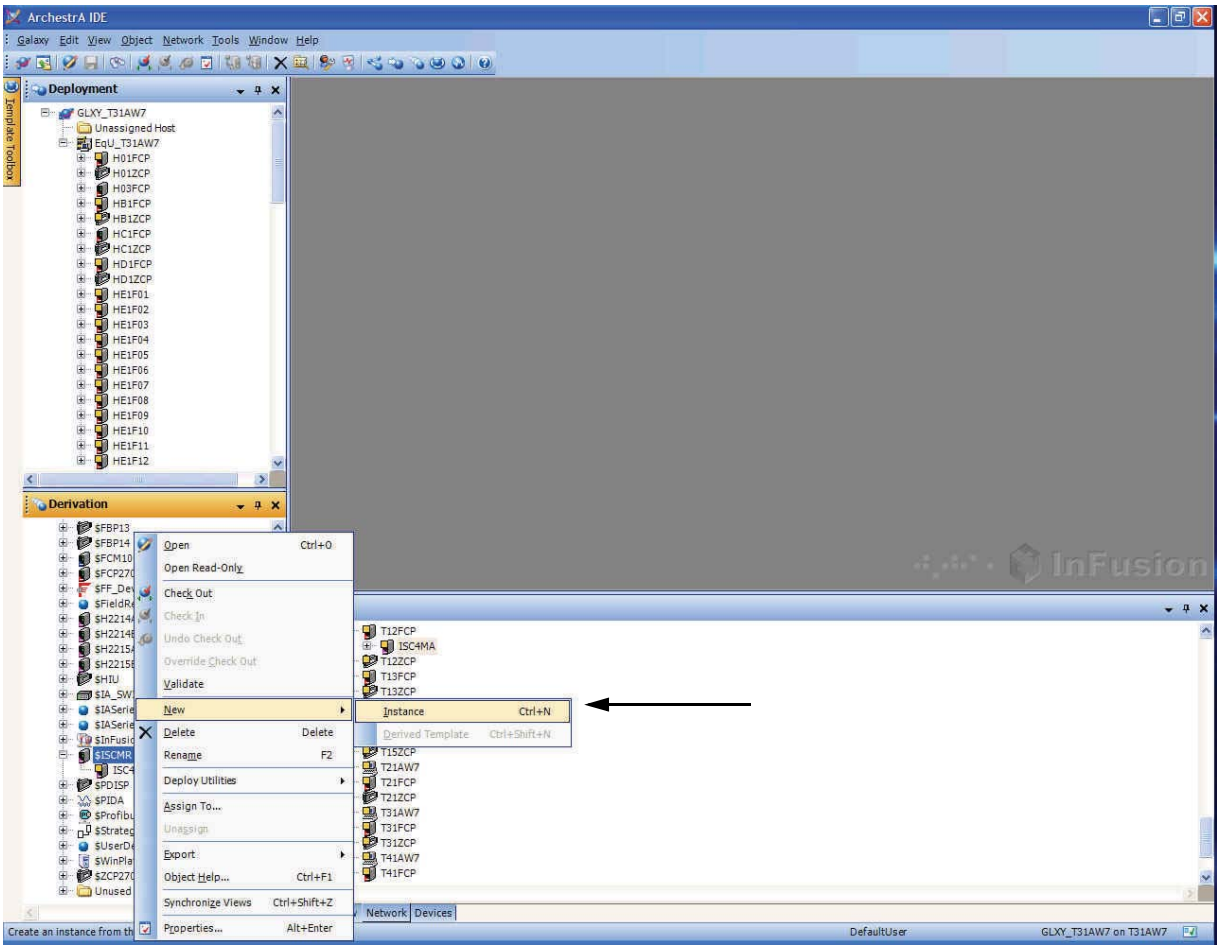


Figure 4-8. Creating a New ECB202 for a Redundant ISCM in IEE (Example)

Figure 4-9 shows how to rename an ECB202 for a redundant ISCM.

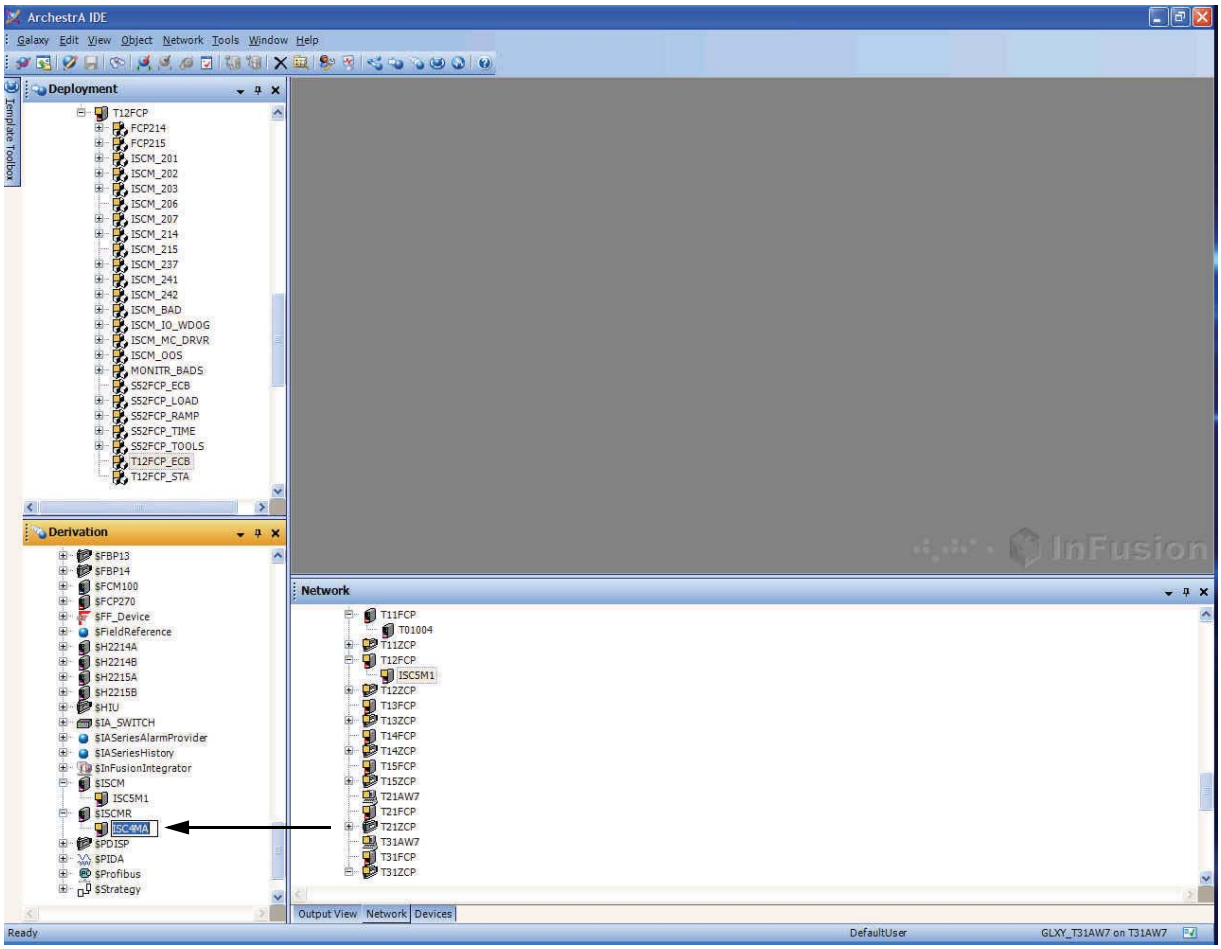


Figure 4-9. Renaming an ECB202 for a Redundant ISCM in IEE (Example)

Figure 4-10 shows how to assign an ECB202 for a redundant ISCM to an FCP270 by a drag-and-drop operation.

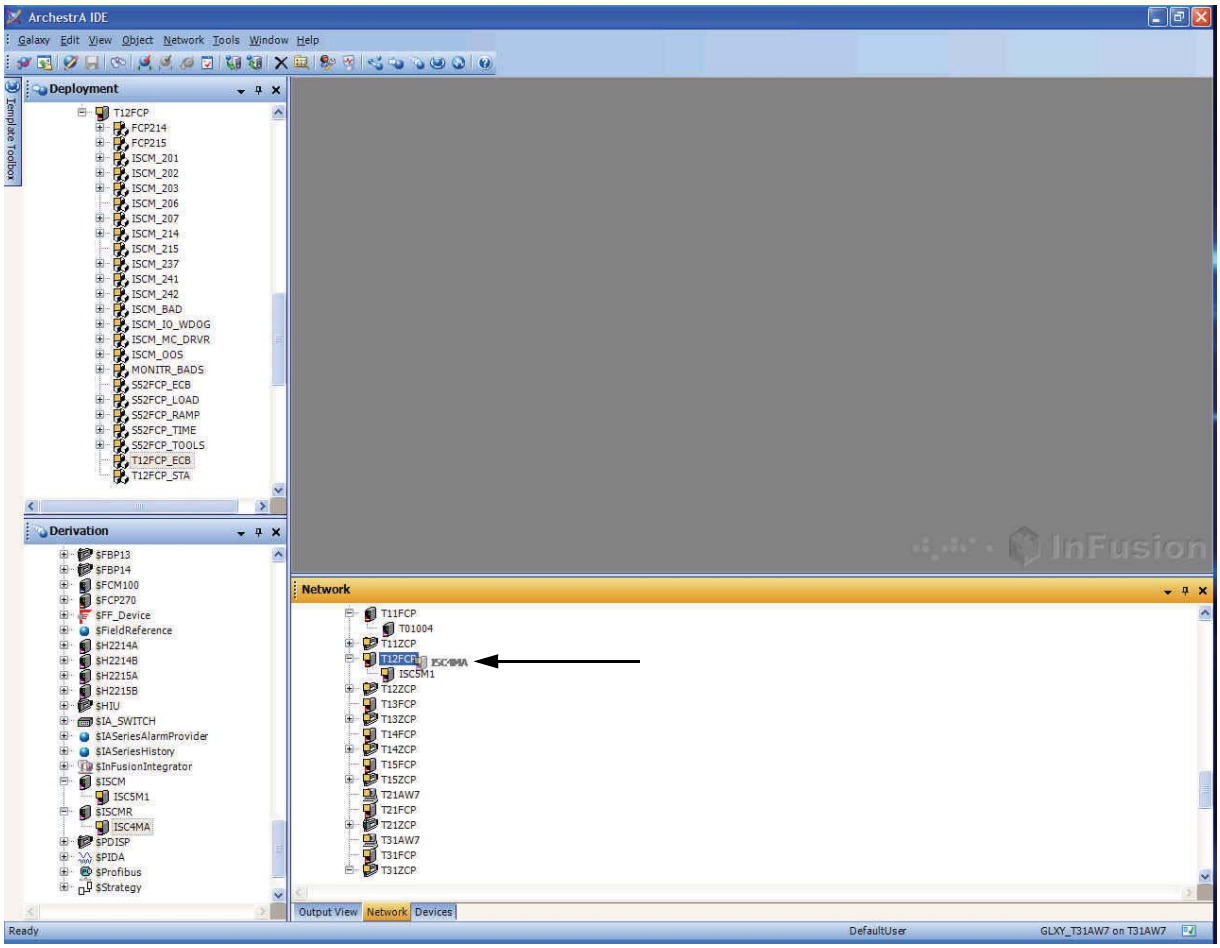


Figure 4-10. Assign an ECB202 for a Redundant ISCM to a FCP270 (via Drag/Drop) in IEE (Example)

Figure 4-11 shows the redundant ISCM assigned to an FCP270 in the IEE's Network View.

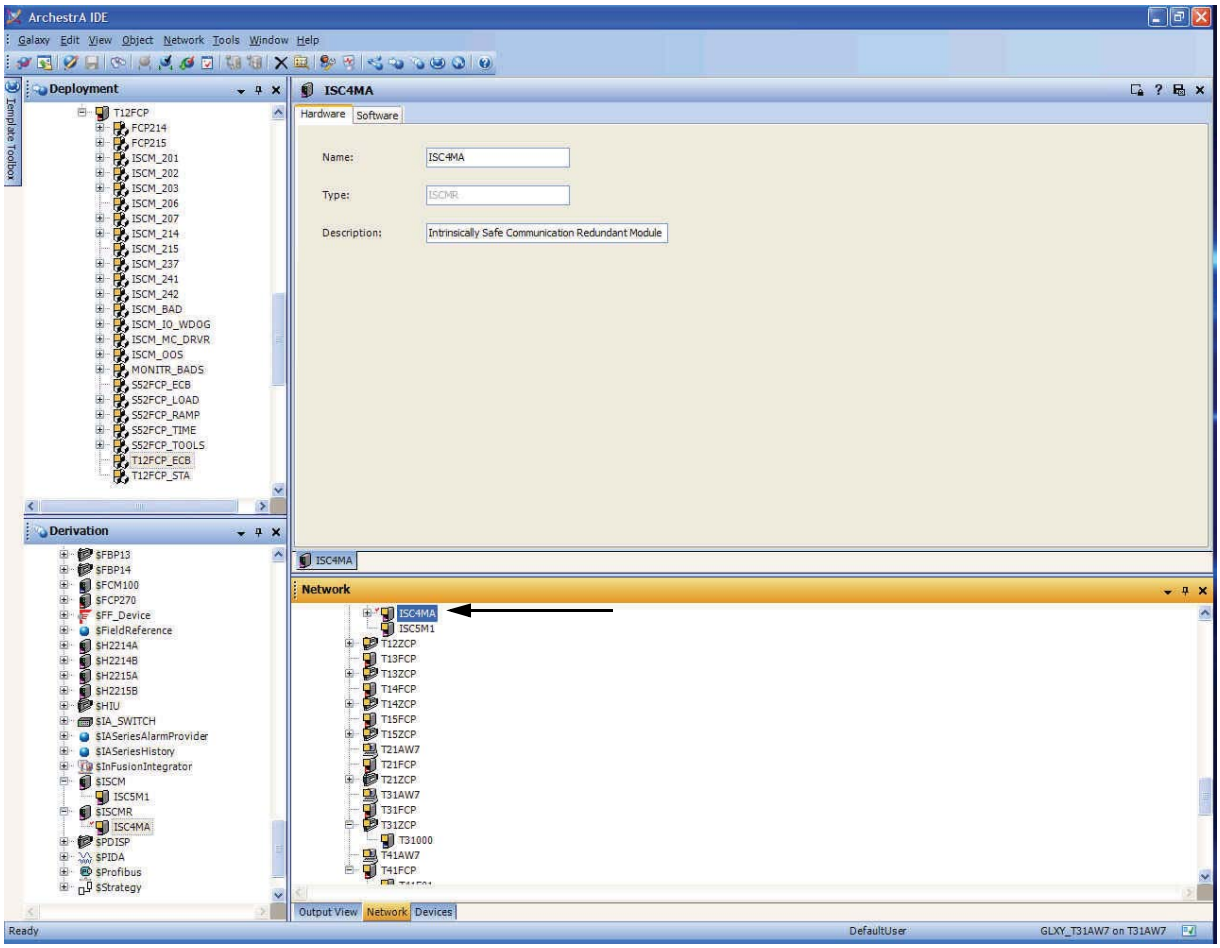


Figure 4-11. Redundant ISCM Assigned to a FCP270 in IEE Network View (Example)

Figure 4-12 shows the Deployment View, General tab, for an ECB202 for a redundant ISCM, which allows you to configure several attributes of the ECB202.

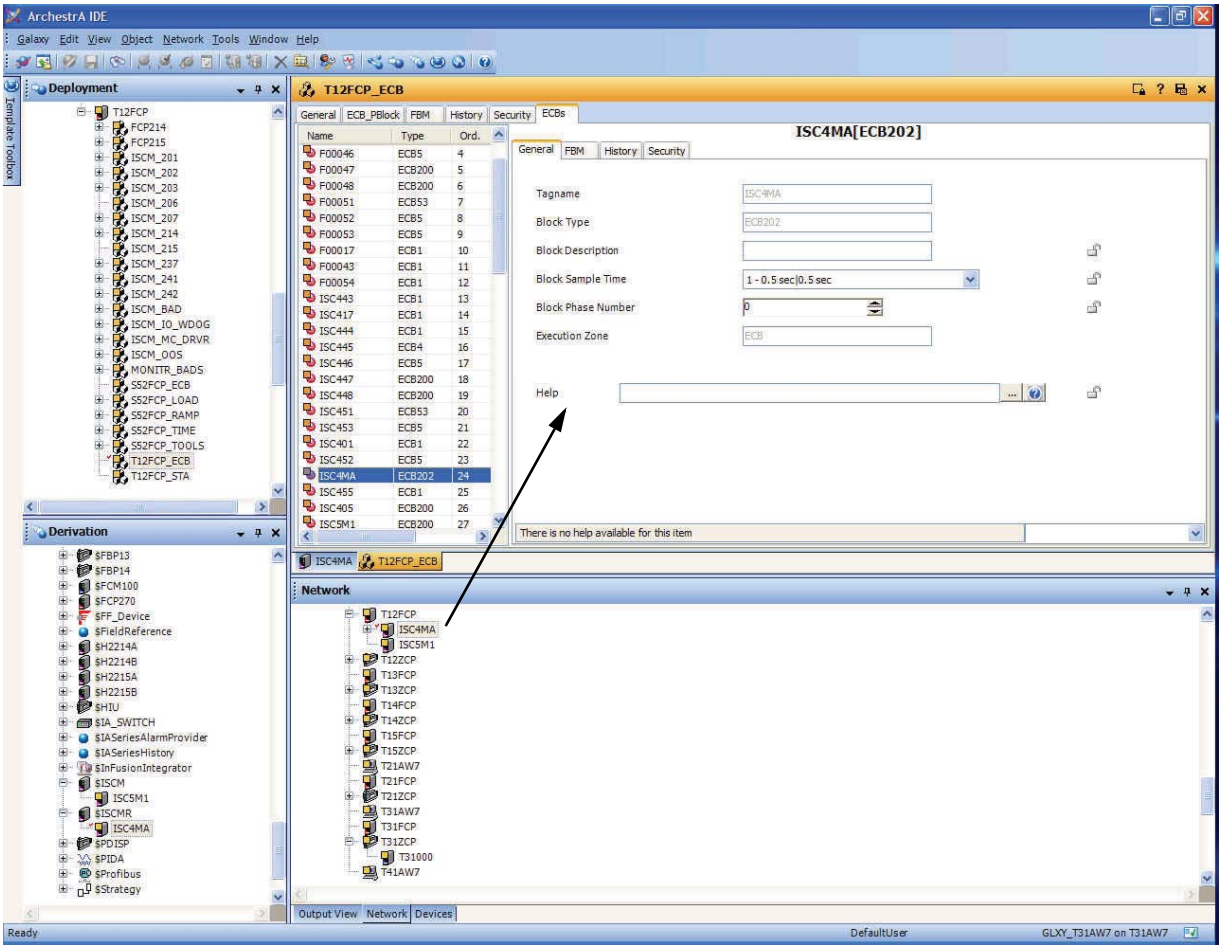


Figure 4-12. Configuring ECB202 for Redundant ISCM in IEE Deployment View, General Tab (Example)

Figure 4-13 shows the Deployment View, FBM tab, for an ECB202 for a redundant ISCM, which allows you to configure several attributes of the ECB202.

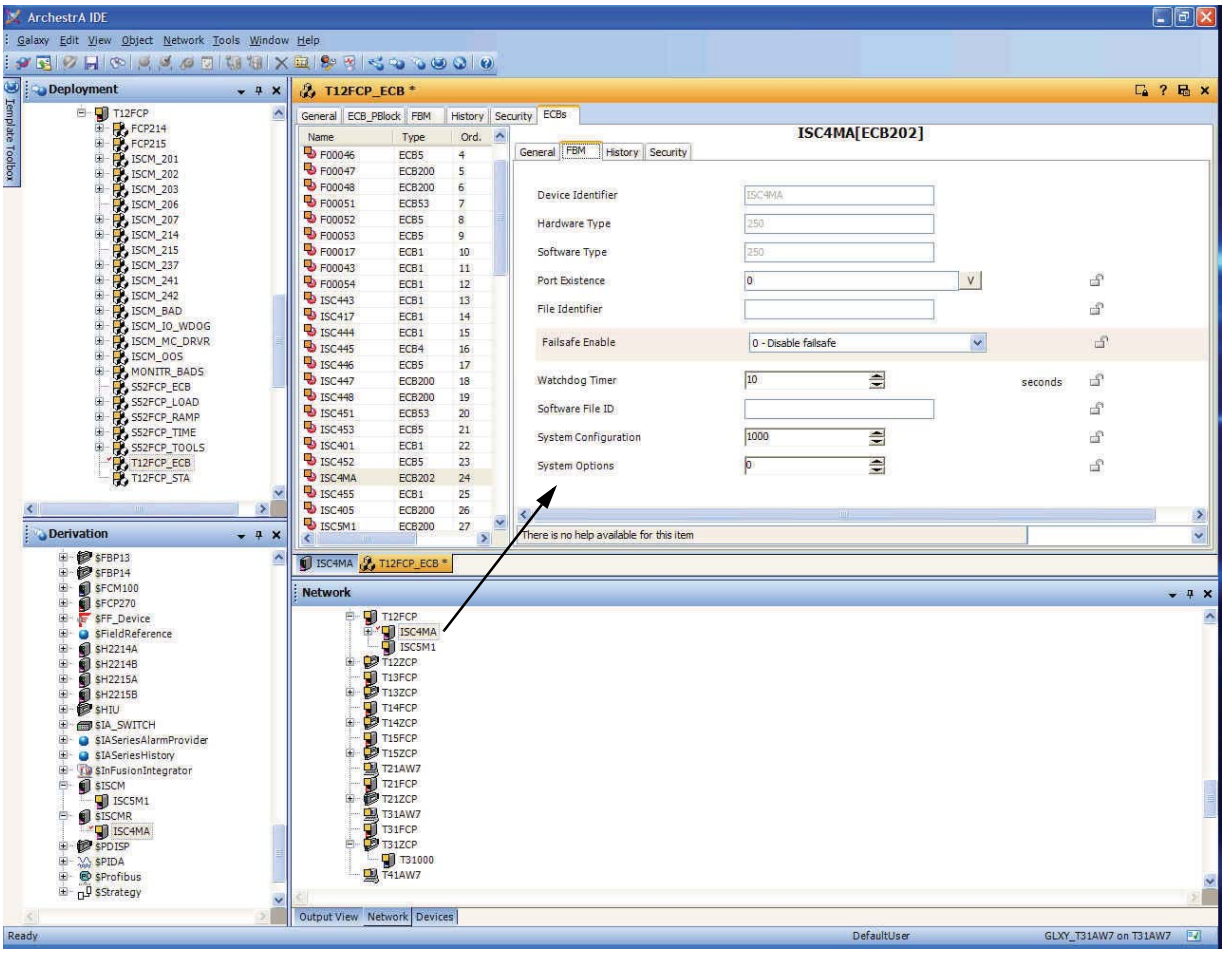


Figure 4-13. Configuring ECB202 for Redundant ISCM in IEE Deployment View, FBM Tab (Example)

NOTE

If the ECB for an ISCM is deleted while the attached I/O modules are running, the modules will continue to run and not automatically go off-line. If you want to turn the modules all off-line before deleting the ISCM ECB, you first must turn the ISCM (or the redundant pair) off-line before deleting the ECB.

ISCM Power Supply Monitoring Option

The ISCM monitors the health of the six LB-style or four FB-style power supplies and reports the loss of power by setting bits in the ISCM's Diagnostic Status 1 byte as shown in Table 5-7 on page 115. The loss of any of the power supplies will also set the Power 1 fail for the base unit or Power 2 fail for the extension unit. This will cause a system alarm for the ISCM and I/O modules if power supply alarming is enabled by setting the 0x02 bit in the BADALM parameter of the PRIMARY_ECB of the CP.

Some configurations by design may not require all of the possible power supplies and therefore the monitoring of any of the six LB-style or four FB-style power supplies may be disabled by setting bits in the SYSOPT parameter for the ISCM in its ECB200 or ECB202. The default for this parameter is 0, which provides monitoring of all of the available power supplies. To disable monitoring for a power supply, set the corresponding bit(s) in SYSOPT for the ISCM ECB as shown in Table 4-2 below. For example, to disable the right-most power supplies on both LB-style base/extension units, set SYSOPT parameter to 0x90 (1001 0000).

Note that SYSOPT is used for a different purpose in the HART intrinsically safe I/O modules to specify the module type.

Table 4-2. SYSOPT Bits in ECB200/202 for Power Supply Monitoring

SYSOPT Bit	Zone 2 ISCM (LB-Style)	Zone 1 ISCM (FB-Style)
0 (LSB)	Unused	Unused
1	Unused	Unused
2	Power supply 1 (left) on main (base) unit	Power supply on main (base) unit
3	Power supply 2 (middle) on main (base) unit	Power supply on redundancy unit
4	Power supply 3 (right) on main (base) unit	Unused
5	Power supply 1 (left) on extension unit	Power supply 1 (upper) on extension unit
6	Power supply 2 (middle) on extension unit	Power supply 2 (lower) on extension unit
7 (MSB)	Power supply 3 (right) on extension unit	Unused

Intrinsically Safe I/O Module Configuration

Each of the intrinsically safe I/O modules inherits the first four characters of the ISCM letterbug. Therefore, the ISCM must be configured before the I/O modules are configured. The fifth and sixth letterbug characters represent the slot number (01-48) where the I/O module is installed. In the case of dual-width I/O modules, the leftmost slot number is used for the letterbug and the rightmost slot number is unused. Dual-width modules may be installed in any slot position so the letterbug for any module may be even or odd.

— NOTE

Although it is possible to configure unused ISCM slots in the FCP to standard 200 Series FBMs, this is not advisable and for that reason, is not supported. Use the FEM100 as shown in Appendix A “CP270 to ISCM Connection Diagrams” to isolate the two systems and thereby avoid potential conflicts.

Each of the I/O modules has a hardware type and software type that must be specified during the ECB configuration process. These two parameters are checked by the ISCM software and must match the hardware and software type for the I/O card that is installed in a given slot or the slot will be marked failed and will not come on-line. The failure code indicated is **15** for a hardware

type mismatch or **16** for a software type mismatch in the "DIAG STATUS 4" field in the appropriate System Management display (I/A Series or InFusion).

In addition, an optional module type code can be specified to provide additional security. Specifying this type code will ensure that only that exact module type can be installed in that slot. If another module type is installed, the failure code **15** will be indicated for a hardware type mismatch in the "DIAG STATUS 4" field on the appropriate System Management display.

The module type code is configured in SYSOPT for modules using ECB200 and in the BUSWDS parameter for modules using all other ECBs. The default value for these parameters is **0**, which disables this strict module type checking.

I/A Series Blocks for Supported LB-Style I/O Modules

Table 4-3 lists the appropriate Equipment Control Blocks (ECBs) and I/O blocks for use in conjunction with the Zone 2 I/O modules (LB-style), the module type codes that can be configured in BUSWDS.

Table 4-3. I/A Series Blocks for Supported Zone 2 IS/IO Modules

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (BUSWDS)	I/O Block
LB 1101 A	Digital Input	207	5	5	0x11	CIN, MCIN
LB 1103 F	Frequency + direction of rotation	206[1]	4	4	0x93	AIN
LB 1104 F	Pulse count + direction of rotation	206[1]	4	4	0x94	AIN, ACCUM
LB 1103 FL	Frequency low + direction of rotation	206[1]	4	4	0x93	AIN
LB 1104 FL	Pulse count low + direction of rotation	206[1]	4	4	0x94	AIN, ACCUM
LB 1108 A	Digital Input	207	5	5	0x18	CIN, MCIN
LB 2101 A	DO with position Feedback	241	5	5	0x21	CIN, MCIN, COUT, MCOUT
LB 2101 E	DO with Position Feedback + shutdown input	241	5	5	0x21	CIN, MCIN, COUT, MCOUT
LB 2102 A	DO with Position Feedback	241	5	5	0x22	CIN, MCIN, COUT, MCOUT
LB 2103 A	DO with Position Feedback	241	5	5	0x23	CIN, MCIN, COUT, MCOUT
LB 2103 E	DO with Position Feedback + shutdown input	241	5	5	0x23	CIN, MCIN, COUT, MCOUT
LB 2104 A	DO with Position Feedback	241	5	5	0x24	CIN, MCIN, COUT, MCOUT
LB 2105 A	DO with Position Feedback	241	5	5	0x25	CIN, MCIN, COUT, MCOUT

Table 4-3. I/A Series Blocks for Supported Zone 2 IS/IO Modules (Continued)

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (BUSWDS)	I/O Block
LB 2105 E	DO with Position Feedback + shut-down input	241	5	5	0x25	CIN, MCIN, COUT, MCOUT
LB 2112 A	DO with Position Feedback	241	5	5	0x2c	CIN, MCIN, COUT, MCOUT
LB 2112 E	DO with Position Feedback + shut-down input	241	5	5	0x2c	CIN, MCIN, COUT, MCOUT
LB 2113 A	DO with Position Feedback	241	5	5	0x2d	CIN, MCIN, COUT, MCOUT
LB 2113 E	DO with Position Feedback + shut-down input	241	5	5	0x2d	CIN, MCIN, COUT, MCOUT
LB 3104 A	Transmitter power	201	1	1	0x34	AIN, MAIN
LB 4104 A	Analog Output	237	53	53	0x44	AOUT; AIN to output
LB 5101 F3	3-wire RTD input	203	1	1	0xd1	AIN, MAIN
LB 5101 F4	4-wire RTD input	203	1	1	0xd1	AIN, MAIN
LB 5102 F	T/C with internal/external CJC RTD input	202	1	1	0xd2	AIN, MAIN
LB 5104 F3	3 wire RTD input	203	1	1	0xd4	AIN, MAIN
LB 5104 F4	4 wire RTD input	203	1	1	0xd4	AIN, MAIN
LB 5105 F	T/C with internal CJC RTD	202	1	1	0xd5	AIN, MAIN
LB 5106 A	0 - 10 V input	201	1	1	0x56	AIN, MAIN
LB 6005 A	Digital Relay output	242	5	5	0x65	COUT, MCOUT; CIN/ MCIN to output
LB 6006 A	Digital Relay output	242	5	5	0x66	COUT, MCOUT; CIN/ MCIN to output
LB 6101 H	Digital Relay output	242	5	5	0x61	COUT, MCOUT; CIN/ MCIN to output
LB 6108 A	20V/8 mA DO per channel, with shut down input	242	5	5	0x68	COUT, MCOUT; CIN/ MCIN to output
LB 6110 A	Solenoid driver uses boost power	242	5	5	0x6a	COUT, MCOUT; CIN/ MCIN to output

Table 4-3. I/A Series Blocks for Supported Zone 2 IS/IO Modules (Continued)

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (BUSWDS)	I/O Block
LB 6110 E	Solenoid driver uses boost power + shut-down input	242	5	5	0x6a	COUT, MCOUT; CIN/ MCIN to output
LB 6111 A	Solenoid driver uses boost power	242	5	5	0x6b	COUT, MCOUT; CIN/ MCIN to output
LB 6111 E	Solenoid driver uses boost power + shut-down input	242	5	5	0x6b	COUT, MCOUT; CIN/ MCIN to output
LB 6112 A	Solenoid driver uses boost power	242	5	5	0x6c	COUT, MCOUT; CIN/ MCIN to output
LB 6112 E	Solenoid driver uses boost power + shut-down input	242	5	5	0x6c	COUT, MCOUT; CIN/ MCIN to output
LB 6113 A	Solenoid driver uses boost power	242	5	5	0x6d	COUT, MCOUT; CIN/ MCIN to output
LB 6113 E	Solenoid driver uses boost power + shut-down input	242	5	5	0x6d	COUT, MCOUT; CIN/ MCIN to output
LB 6114 A	Solenoid driver uses boost power	242	5	5	0x6e	COUT, MCOUT; CIN/ MCIN to output
LB 6114 E	Solenoid driver uses boost power + shut-down input	242	5	5	0x6e	COUT, MCOUT; CIN/ MCIN to output
LB 6115 A	Solenoid driver uses boost power	242	5	5	0x6f	COUT, MCOUT; CIN/ MCIN to output
LB 6115 ES	Solenoid driver uses boost power + shut-down input	242	5	5	0x6f	COUT, MCOUT; CIN/ MCIN to output

[1.] For the FBM206, the direction input will change the pulse count modules from up count to down count. Refer to the footnote on page 86.

Fail-Safe Operation

Fail-Safe Action for Non-HART Output Modules

Fail-safe parameters in the controlling ECBs specify the outputs of the associated output module in the event of a module failure or a break in communication with the Controller. All fail-safe

operations are initiated by the ISCM, and all fail-safe parameters are downloaded each time the output modules are initialized.

Each time the ISCM receives a write request for an output module, it resets a fail-safe timer for its associated ECB. The ISCM asserts a fail-safe condition for the ECB if it does not receive another output command within a specified time. The fail-safe condition can be either of the following:

- Hold Current Value - Hold the value sent in the most recent output command from the Controller.
- Use Fallback Value - Use a value specified for the output (specified in the ECB).

The ECBs for the output modules include parameters for enabling and disabling fail-safe and for setting a fail-safe delay for the outputs. These parameters are downloaded to the output module's database from the Controller each time the module is initialized or reconfigured, and each time you execute a download command from the System Management display. If fail-safe is enabled for a specific output, the ISCM asserts fail-safe actions for each of the outputs.

When normal operation resumes, the current output values are read by the Controller and stored in the ECBs. These values in turn are used by the I/O blocks as the starting point for new output commands.

NOTE

Fail-safe operation for an output module requires that a process block be connected to the output module's ECB.

Fail-safe actions that occur during various failed conditions are dependant upon two things: the configuration of the module's fail-safe parameters and the type of failure. Two basic types of failures can occur:

- Type 1 failures, such as FBM OFF-LINE, FBM DOWNLOAD, FBM EEPROM UPDATE, simulate a module failure
- Type 2 failures (COMM FAIL), involve a loss of communications to the module.

Fail-Safe for Type 1 Failures - Module FAIL

Two ECB parameters, fail-safe mask (FSMM53 or FSMM05) and fail-safe data (FSnD53 [n=1 to 8] or FSDM05), determine the action that the output module takes when a Type 1 failure occurs. FSMM53, configured for a particular analog output or FSMM05 configured for a particular digital output determines the state that is asserted at the output: Fallback Value (0), or Hold Current Value (1). The default setting of the fail-safe mask parameter is zero, to assert the Fallback Values. The mask can be set so that some outputs hold while others fall back. FSnD53, also configured for a particular analog output, or FSDM05 configured for a particular digital output, determines the fallback value. The default value for analog outputs is zero, and the default value for digital values is false.

Fail-Safe for Type 2 Failures - COMM FAIL

In addition to the fail-safe mask and fail-safe data parameters, there are two other ECB parameters, FSENAB and FSDLAY that affect the output module's response to communications failures. FSENAB determines whether the output simply holds its output value during the communications failure (FSENAB = 0) until the communications failure ceases, or if it delays fail-safe action (FSENAB = 1) for the time specified by FSDLAY and then responds in the same way as Type 1 failures.

Fail-Safe Examples

The following examples are fail-safe operations for an analog output module type ECB53 with up to four outputs. The operation is performed for the first output point, which is point number 1. An AOUT block is used, and the output is driven at a value of 75% of full scale. The Fallback Value is configured to be 25% of full scale (FS1D53 = 16000). FSDLAY is set to 1000, which is equal to a delay time of 10 seconds.

Example 1: FSENAB = 0 and FSMM53 = 0X00

a. Cause: Type 1 failure.

Result: Output immediately goes to 25%.

a. Cause: Type 2 failure.

Result: Output holds at 75%.

Example 2: FSENAB = 0 and FSMM53= 0X10

a. Cause: Type 1 failure.

Result: Output holds at 75%.

b. Cause: Type 2 failure.

Result: Output holds at 75%.

Example 3: FSENAB = 1 and FSMM53 = 0X00

a. Cause: Type 1 failure.

Result: Output immediately goes to 25%.

b. Cause: Type 2 failure.

Result: Output holds at 75% for 10 seconds, and then goes to 25%.

Example 4: FSENAB = 1 and FSMM53 = 0X10

a. Cause: Type 1 failure.

Result: Output holds at 75%.

b. Cause: Type 2 failure

Result: Output holds at 75% for 10 seconds, and then continues to hold at 75%.

Fail-Safe Actions for HART Output Modules

Fail-safe actions are performed in accordance with specific parameters set in the ECB200, device ECB201 and in the ROUT DCI blocks for the output module. In the ECB200, the following parameters control fail-safe actions:

- FSENAB - Fail-Safe Enable, when true, activates the FSDLAY timer to detect a communication failure from the control station, and start fail-safe action in the output module. The FSENAB setting is downloaded to the ISCM when the output module is rebooted. It is used by the ISCM to enable/disable the logic to assert fail-safe action when a loss of control station communication is detected, or when a control station fail-safe request is received.
- FSDLAY - Fail-Safe Delay is a communications fail timer. When enabled by FSENAB, it specifies the length of time (in units of 0.01 seconds) that the output module can be without communication from the control station before taking fail-safe action. If bit 2 (0x04) is also set in the FSOPTN parameter of the ROUT control block, the ISCM asserts fail-safe and drives its output to the fail-safe value. For exam-

ple, the default value of 1000 in FSDLAY causes the ISCM to wait ten seconds between read/write messages for the output module before going to the Fail-safe state, provided FSENAB is also configured true.

In the ROUT DCI block, the following parameters control fail-safe actions:

- FSOPTN - Fail-safe Option is a configurable option that specifies the fail-safe conditions and action to be taken in the FBM for an output point in a ROUT block:
  - Bit 0 (0x01): Assert fail-safe if input/measurement error.
  - Bit 1 (0x02): Set or clear fail-safe when SETFS input is set or cleared.
  - Bit 2 (0x04): Assert fail-safe if control station to output module communication failure was detected by the ISCM.

  Combinations of these conditions for fail-safe can be specified.
- SETFS - Set Fail-safe Request is a settable Boolean parameter that requests fail-safe action to be set or reset by the output module to the specific fail-safe value configured in the ROUT block.
- FSOUT - Fail-safe Output specifies the real fail-safe value that is to be used by the output module when any condition specified in FSOPTN exists.

The DISABLE COMMUNICATIONS equipment change pick for the device ECB201 on the System Management display will also set fail-safe according to the ROUT block bit 2 in FSOPTN and the value in FSOUT. The FSENAB parameter in the ECB200 does not affect this particular fail-safe action.

Fail-Safe Action for ISCMs

The ISCM invokes the Type 1 fail-safe action for all of the attached output modules when the single ISCM or both ISCMs of a redundant pair are placed off line, downloaded or EEPROM updated from equipment change actions through System Management. Refer to the sections above for non-HART and HART Type 1 fail-safe actions.

Although FSENAB and FSDLAY are configurable in the ECB200 and ECB202 for the ISCM, these parameters do not affect the Type 2 fail-safe actions when a communication failure occurs for the ISCM or the output modules. Each individual output module must be configured separately to control the fail-safe action for that output module when a communication failure occurs.

If the master ISCM module has a hardware failure and a redundant ISCM partner is on line, the redundant ISCM will take over and Type 1 fail-safe will not be invoked. However, if the ISCM is alone or its redundant partner is off line, then the action taken will depend upon the type of failure. A failure in the fieldbus communication hardware in the ISCM will result in the setting of Type 1 fail-safe actions configured for each of the output modules. If a failure in the ISCM I/O modules' communication bus hardware occurs, all modules will set their analog outputs to zero current and digital outputs to their off states. All outputs will also go to zero if both ISCMs are removed from the base/extension unit.

Output Shutdown

With certain I/O modules, it is possible to use a bus-independent control input to shut down the output. These I/O modules include digital and analog outputs with a separate output disable input.

Safety Integrity Level (SIL) 2 can be achieved by installing these I/O modules. Refer to each module's associated hardware manual and to their technical documentation (which can be found in "P+F Intrinsically Safe I/O Modules Overview Specifications" on page xv).

NOTE

These modules will only work under system control when the shutdown contact on their base/extension unit is closed or the shutdown voltage source is energized.

InFusion Configuration Screens for LB-Style Zone 2 I/O Modules

The following figures provide examples of how to configure ECBs for Zone 2 I/O modules in the InFusion Engineering Environment (IEE). For details on performing this task in InFusion, refer to *InFusion Block Configurator, Control Edition* (B0750AH).

Figures for configuring ECBs for Zone 2 I/O modules in ICC are available in "ICC Configuration Screens for LB-Style I/O Modules" on page 153.

Example InFusion Configuration Screens for LB 3104 Module

Figure 4-14 shows how to create a new ECB1 for an LB 3104 module in the IEE's Network View.

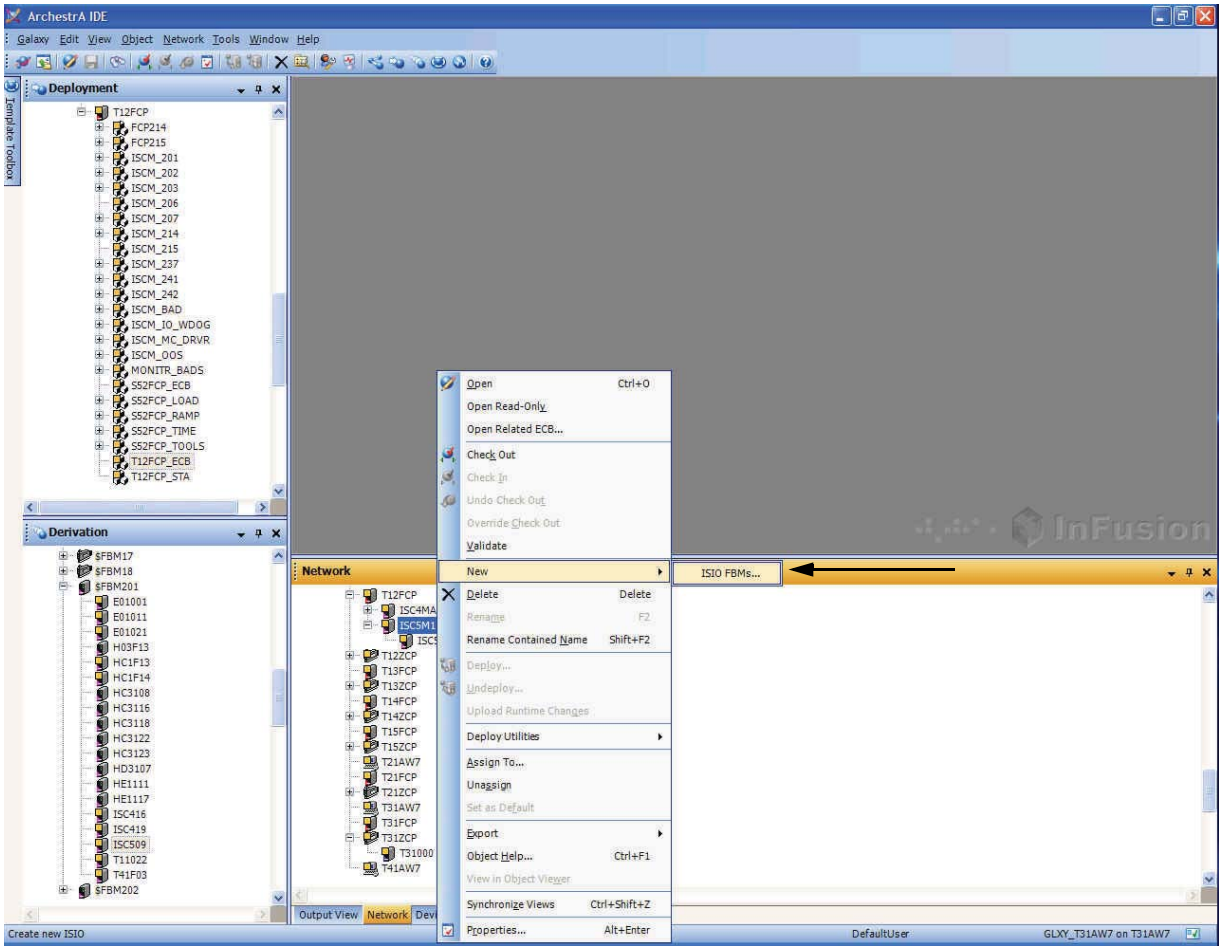
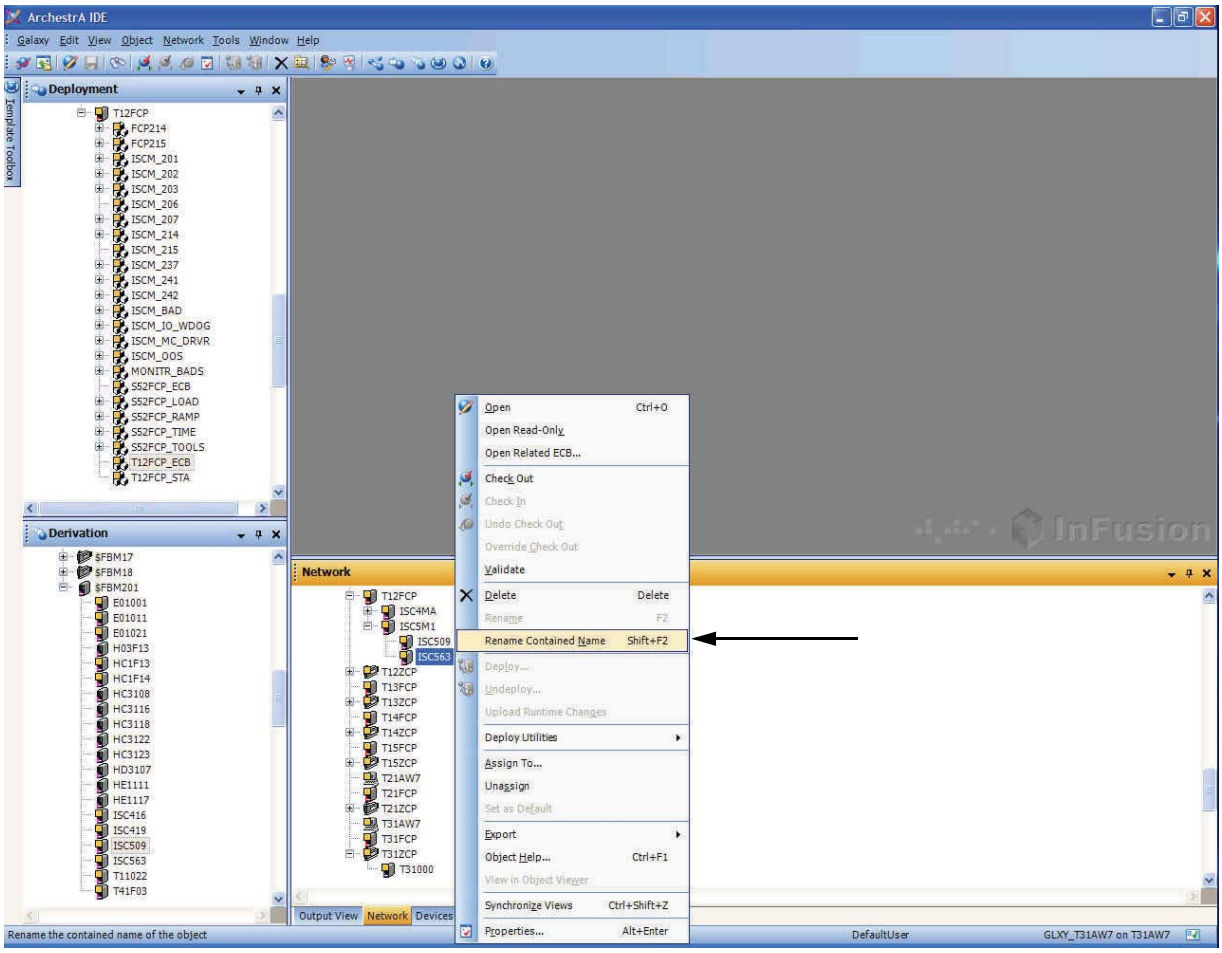


Figure 4-14. Creating an ECB1 for an LB 3104 Module in IEE (Example)

Figure 4-15 shows how to rename an ECB1 for an LB 3104 module.



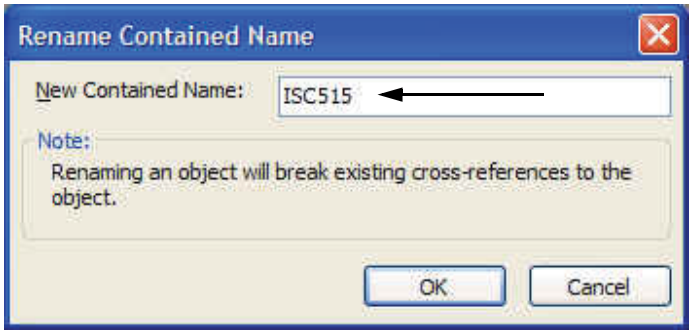


Figure 4-15. Renaming an ECB1 for an LB 3104 Module in IEE (Example)

Figure 4-16 shows the Deployment View, General tab, for an ECB1 for an LB 3104 module, which allows you to configure several attributes of the ECB1.

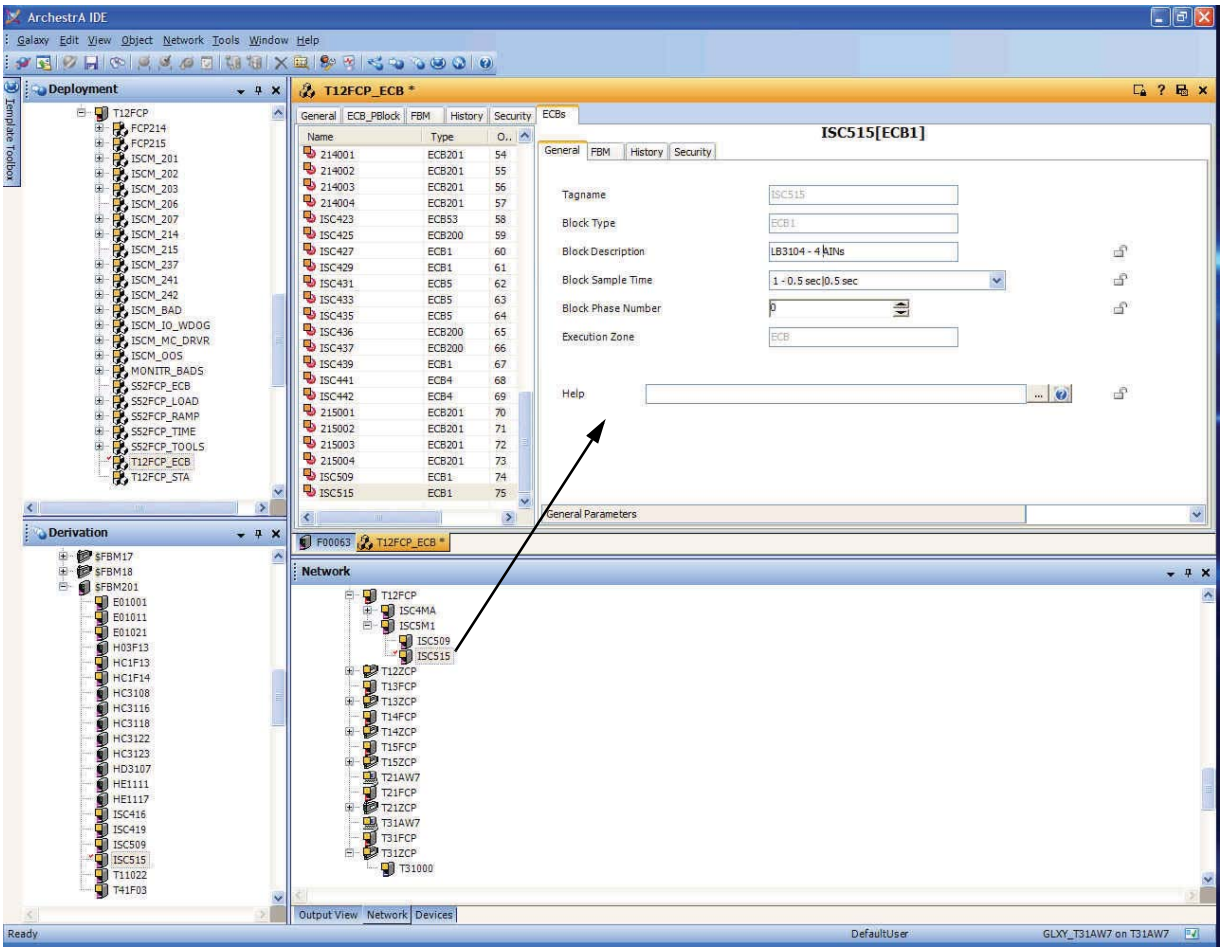


Figure 4-16. Configuring ECB1 for an LB 3104 Module in IEE Deployment View, General Tab (Example)

Figure 4-17 shows the Deployment View, FBM tab, for an ECB1 for an LB 3104 module, which allows you to configure several attributes of the ECB1.

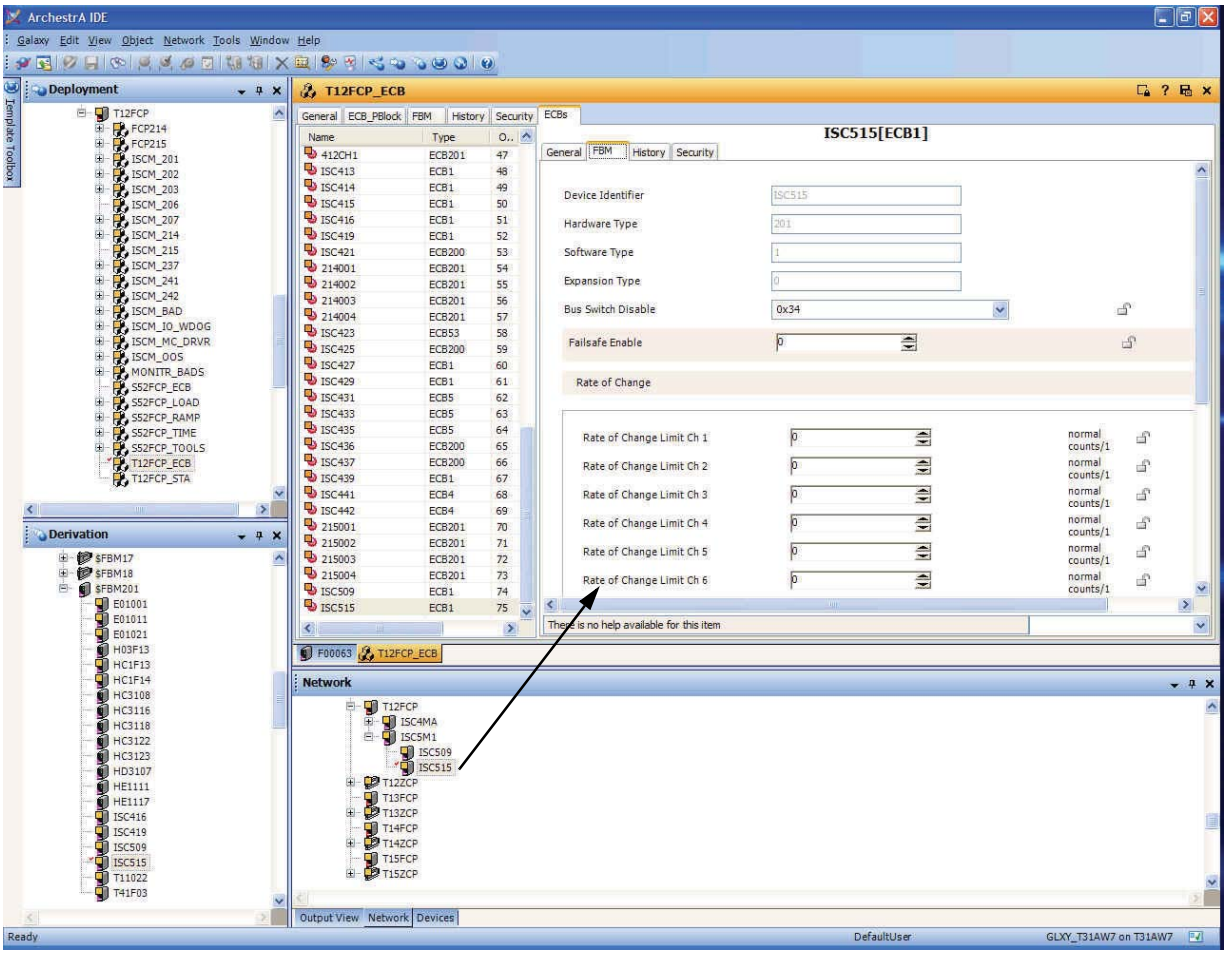


Figure 4-17. Configuring ECB1 for an LB 3104 Module in IEE Deployment View, FBM Tab (Example)

Example InFusion Configuration Screens for LB 4104 Module

Figure 4-18 shows how to create a new ECB53 for an LB 4104 module in the IEE's Network View.

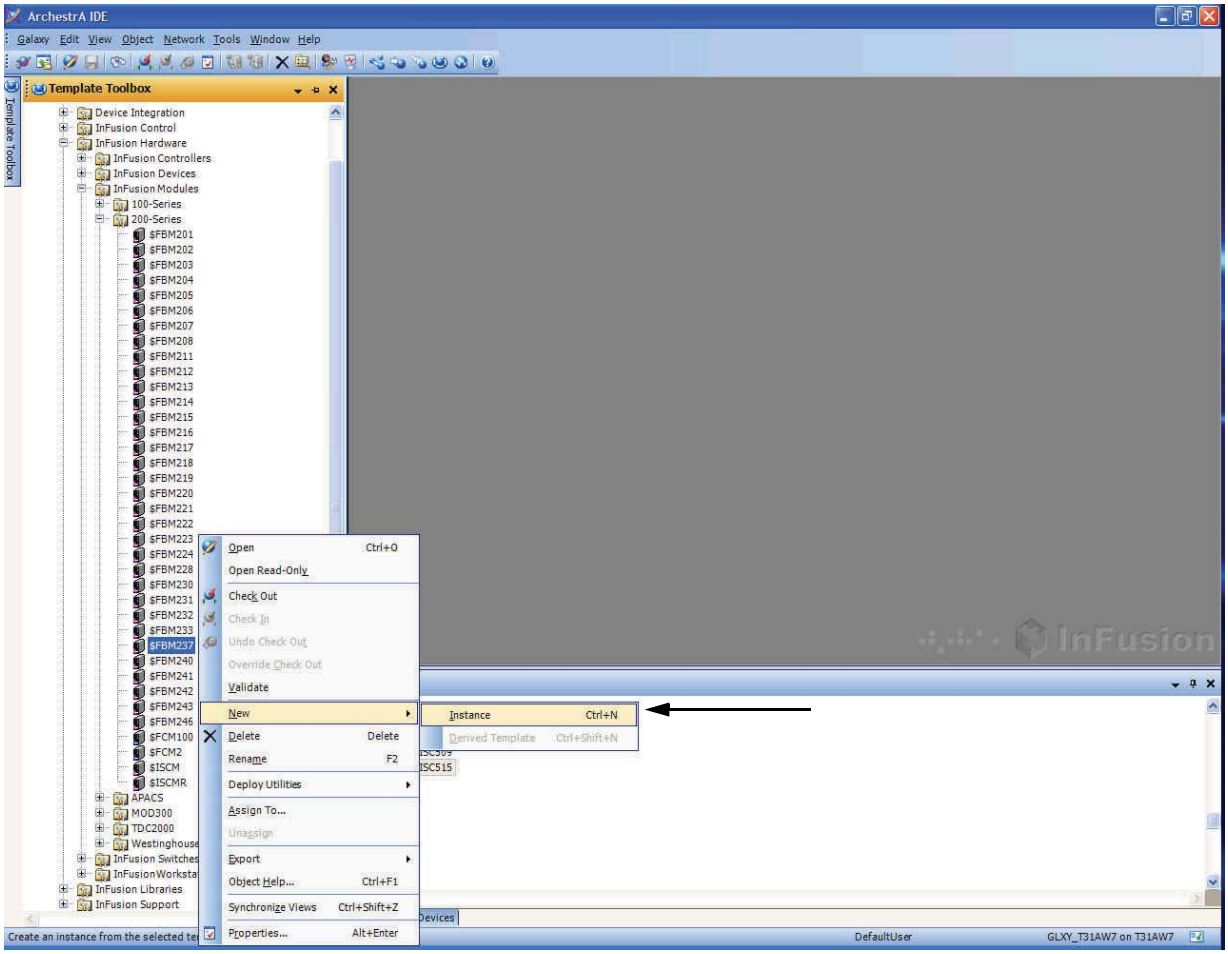


Figure 4-18. Creating an ECB53 for an LB 4104 Module in IEE (Example)

Figure 4-19 shows how to rename an ECB53 for an LB 4104 module.

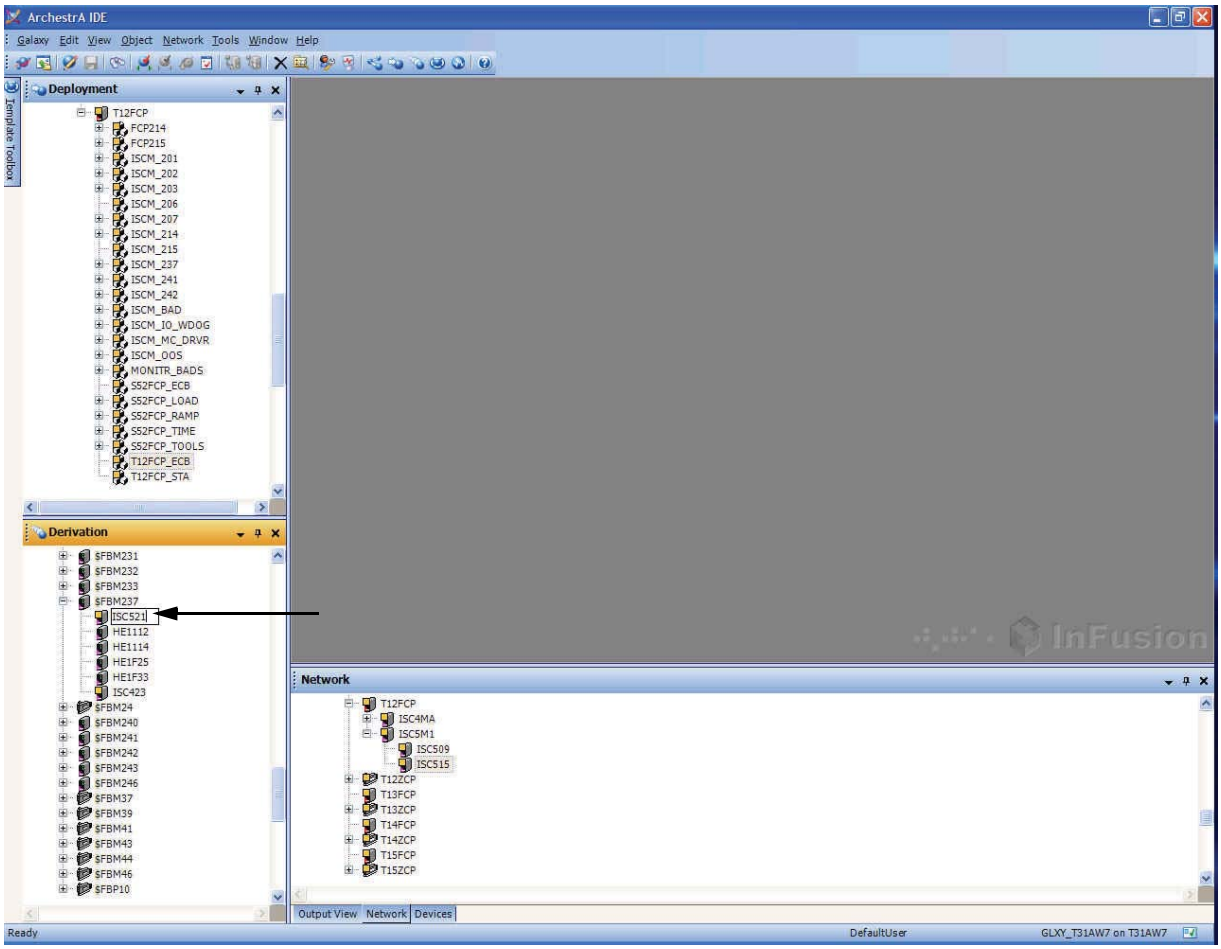


Figure 4-19. Renaming an ECB53 for an LB 4104 Module in IEE (Example)

Figure 4-20 shows how to assign an ECB53 for an LB 4104 module to an ISCM by a drag-and-drop operation.

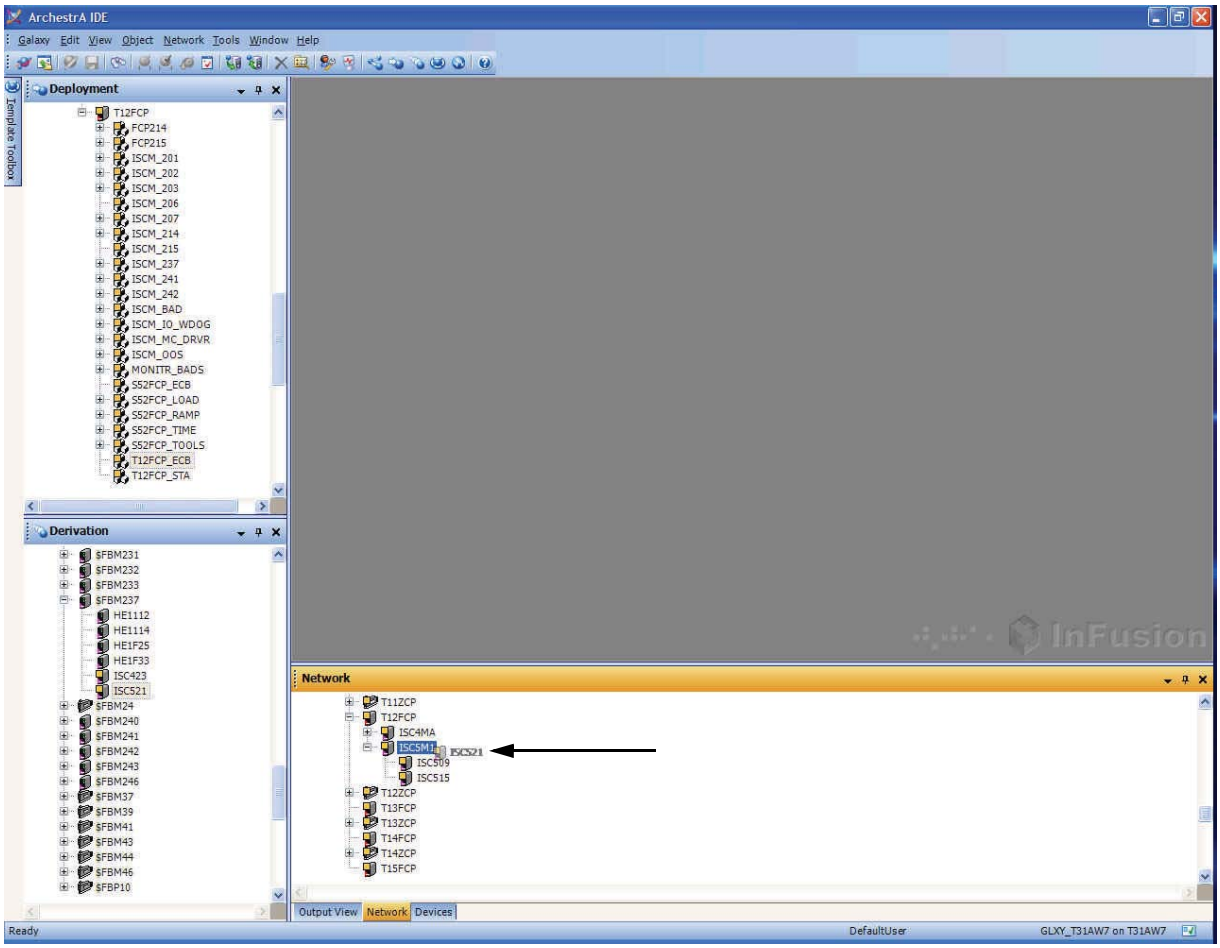


Figure 4-20. Assign an ECB53 for an LB 4104 Module to an ISCM (via Drag/Drop) in IEE (Example)

Figure 4-21 shows the Deployment View, General tab, for an ECB53 for an LB 4104 module, which allows you to configure several attributes of the ECB53.

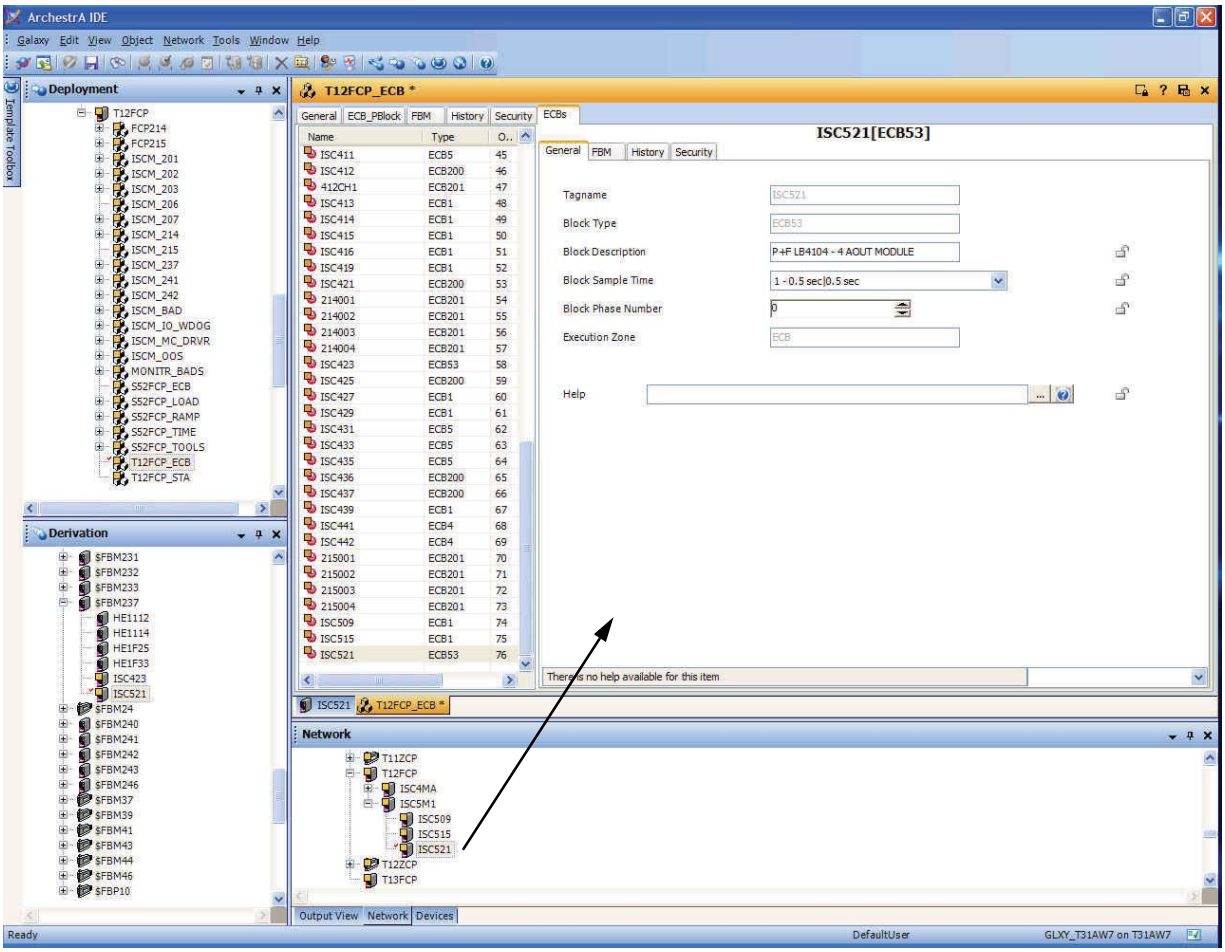


Figure 4-21. Configuring ECB53 for an LB 4104 Module in IEE Deployment View, General Tab (Example)

Figure 4-22 shows the Deployment View, FBM tab, for an ECB53 for an LB 4104 module, which allows you to configure several attributes of the ECB53.

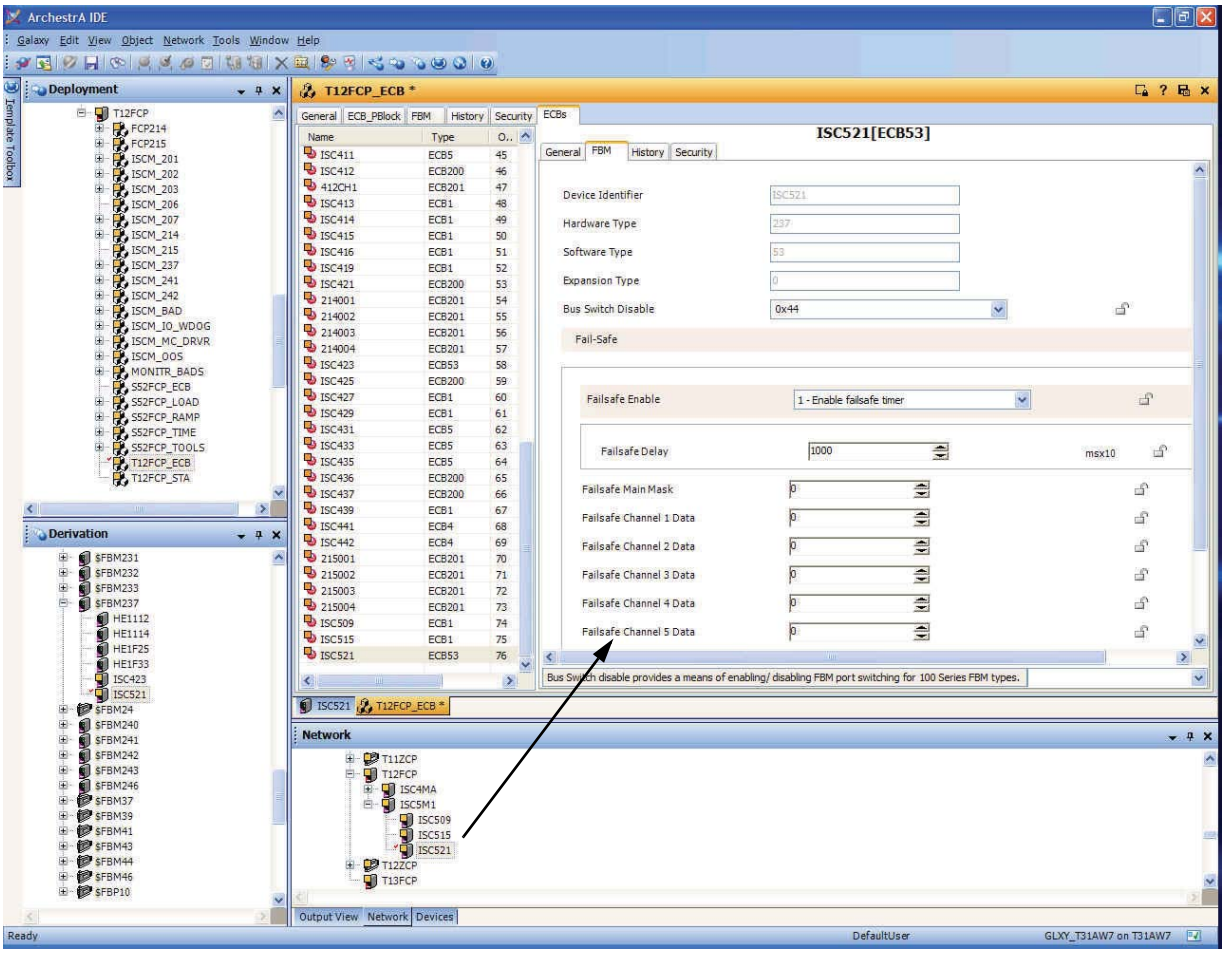


Figure 4-22. Configuring ECB53 for an LB 4104 Module in IEE Deployment View, FBM Tab (Example)

I/A Series Blocks for Supported LB-Style HART I/O Modules

Table 4-4 lists the appropriate Equipment Control Blocks (ECBs) and I/O blocks for use in conjunction with the Zone 2 HART I/O modules (LB-style), the module type codes that can be configured in SYSOPT.

Table 4-4. I/A Series Blocks for Supported Zone 2 HART IS/IO Modules

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (SYSOPT)	I/O Block
LB 3102 A	HART input with Transmitter power (16.5V)	214	200 and one 201	214	0x32	IIN, RIN, STRIN, PAKIN
LB 3105 A	HART and Transmitter power	214	200 and four 201s	214	0x35	IIN, RIN, STRIN, PAKIN
LB 4102 A	HART output	215	200 and one 201	215	0x42	IIN, ROUT, RIN, STRIN, PAKIN
LB 4102 C	HART output with shutdown input	215	200 and one 201	215	0x42	IIN, ROUT, RIN, STRIN, PAKIN
LB 4105 C	HART output with shutdown input	215	200 and four 201s	215	0x45	IIN, ROUT, RIN, STRIN, PAKIN
LB 4105 D	HART output with LFD	215	200 and four 201s	215	0x45	IIN, ROUT, RIN, STRIN, PAKIN

InFusion Configuration Screens for LB-Style Zone 2 HART I/O Modules

The following figures provide examples of how to configure ECBs for Zone 2 HART I/O modules in the InFusion Engineering Environment (IEE). For details on performing this task in InFusion, refer to *InFusion Block Configurator, Control Edition* (B0750AH).

Figures for configuring ECBs for Zone 2 HART I/O modules in ICC are available in “ICC Configuration Screens for LB-Style HART I/O Modules” on page 155.

Example InFusion Configuration Screens for LB 3102 (HART) Module

Figure 4-23 shows how to create a new ECB200 for an LB 3102 module in the IEE's Network View.

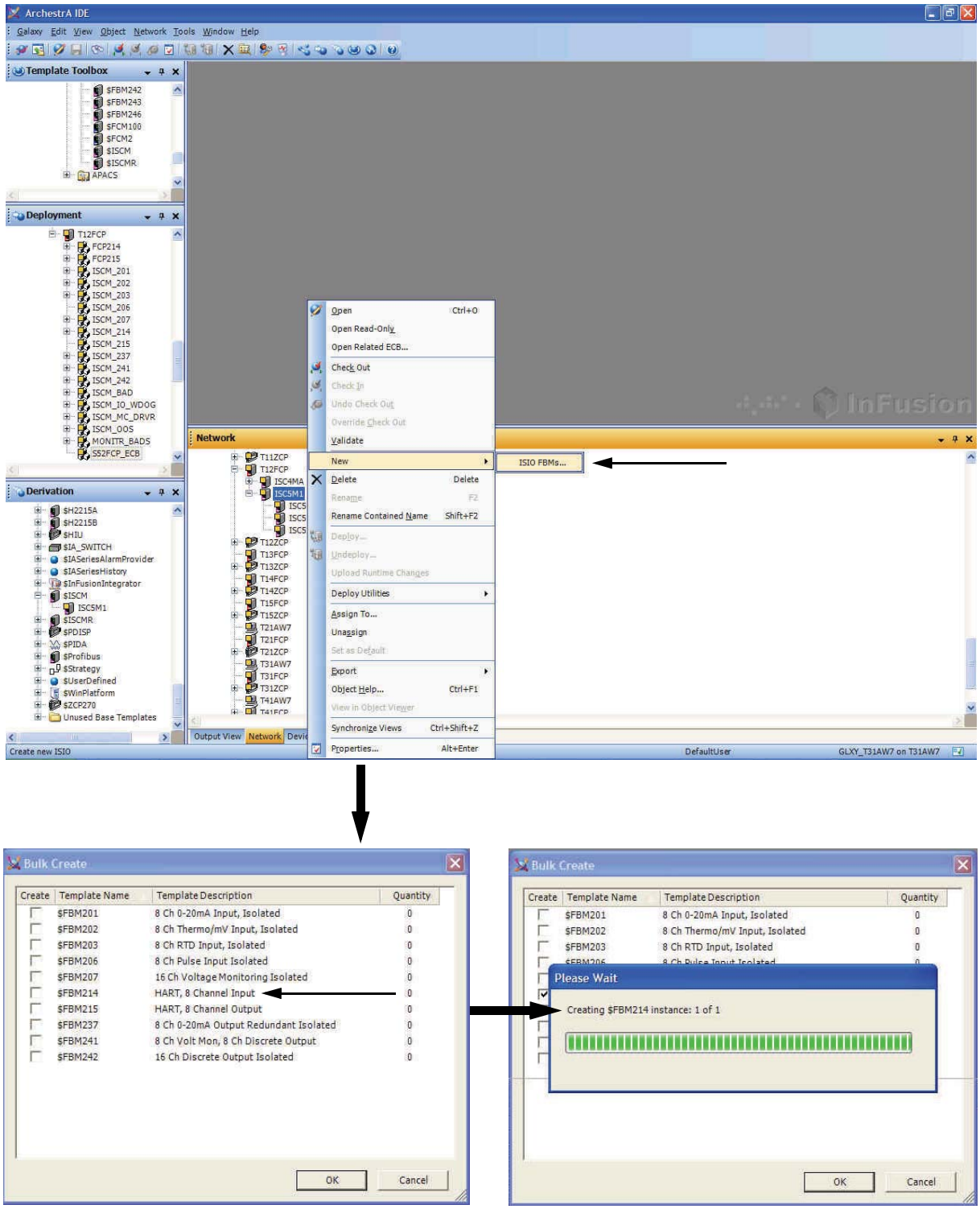


Figure 4-23. Creating an ECB200 for an LB 3102 (HART) Module in IEE (Example)

Figure 4-24 shows the Deployment View, General tab, for an ECB200 for an LB 3102 module, which allows you to configure several attributes of the ECB200.

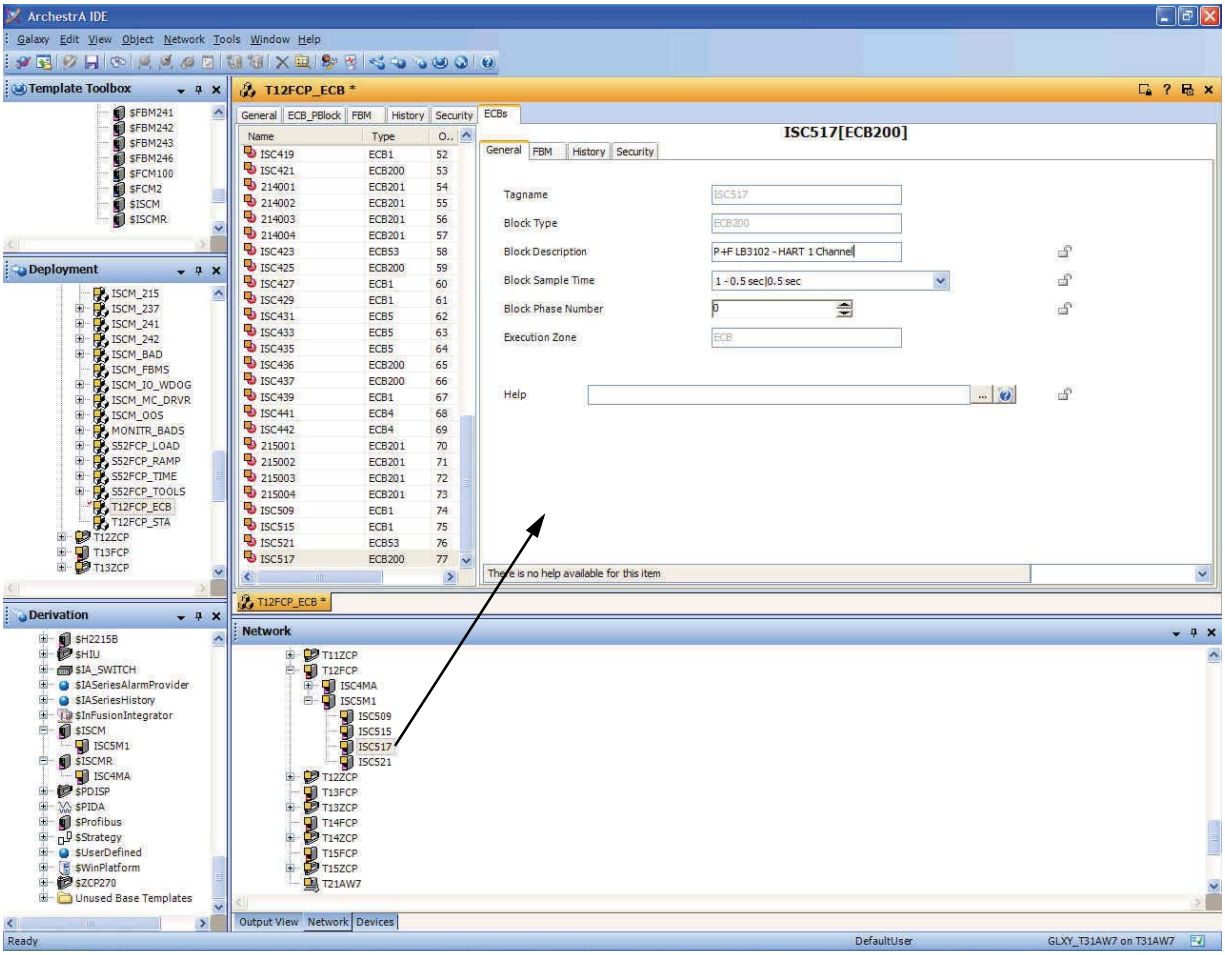


Figure 4-24. Configuring ECB200 for an LB 3102 (HART) Module in IEE Deployment View, General Tab (Example)

Figure 4-25 shows the Deployment View, FBM tab, for an ECB200 for an LB 3102 module, which allows you to configure several attributes of the ECB200.

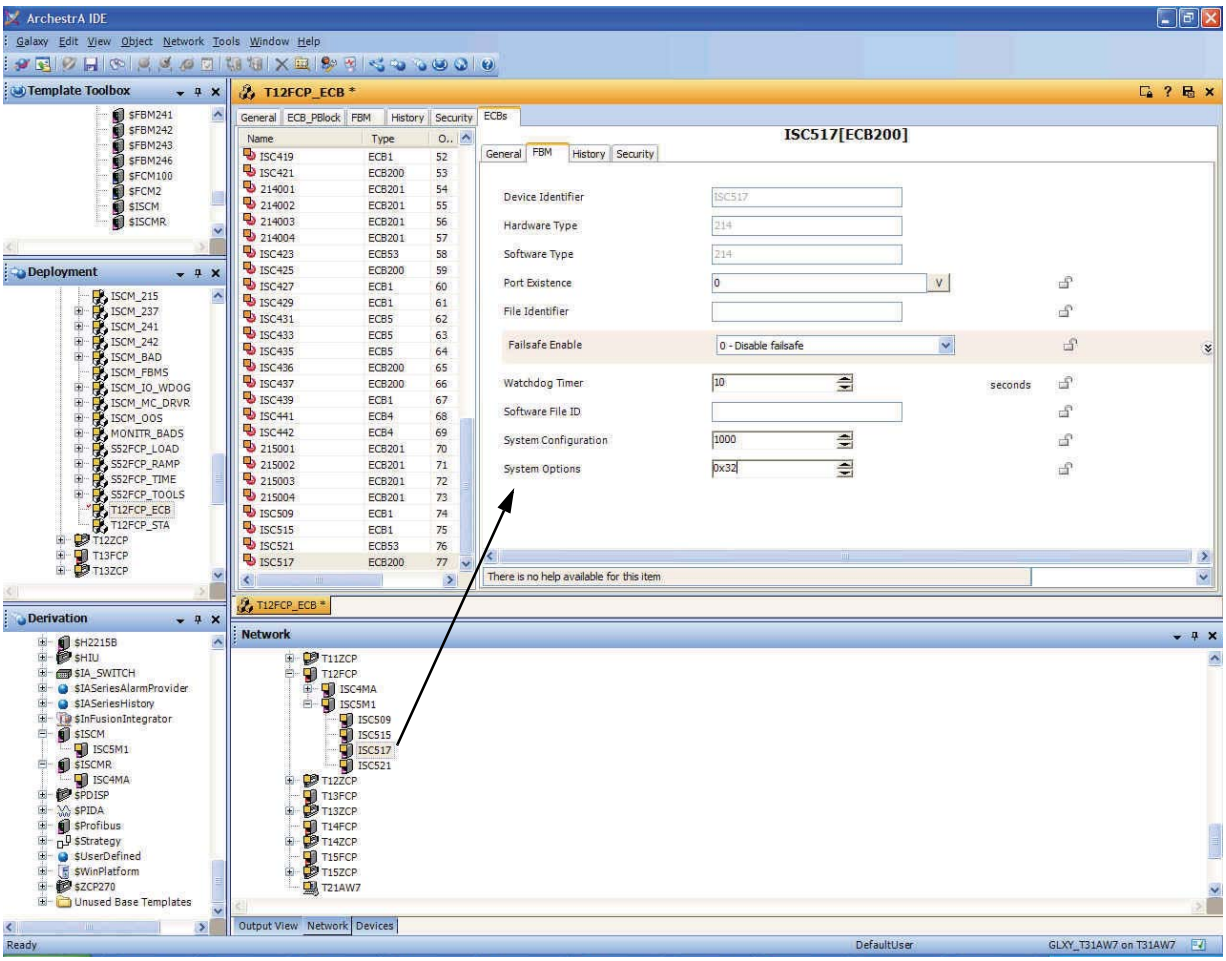


Figure 4-25. Configuring ECB200 for an LB 3102 (HART) Module in IEE Deployment View, FBM Tab (Example)

Example InFusion Configuration Screens for LB 3102 (HART) Module's HART Device

Figure 4-26 shows how to create a new ECB201 for an LB 3102 module's HART device in the IEE's Network View.

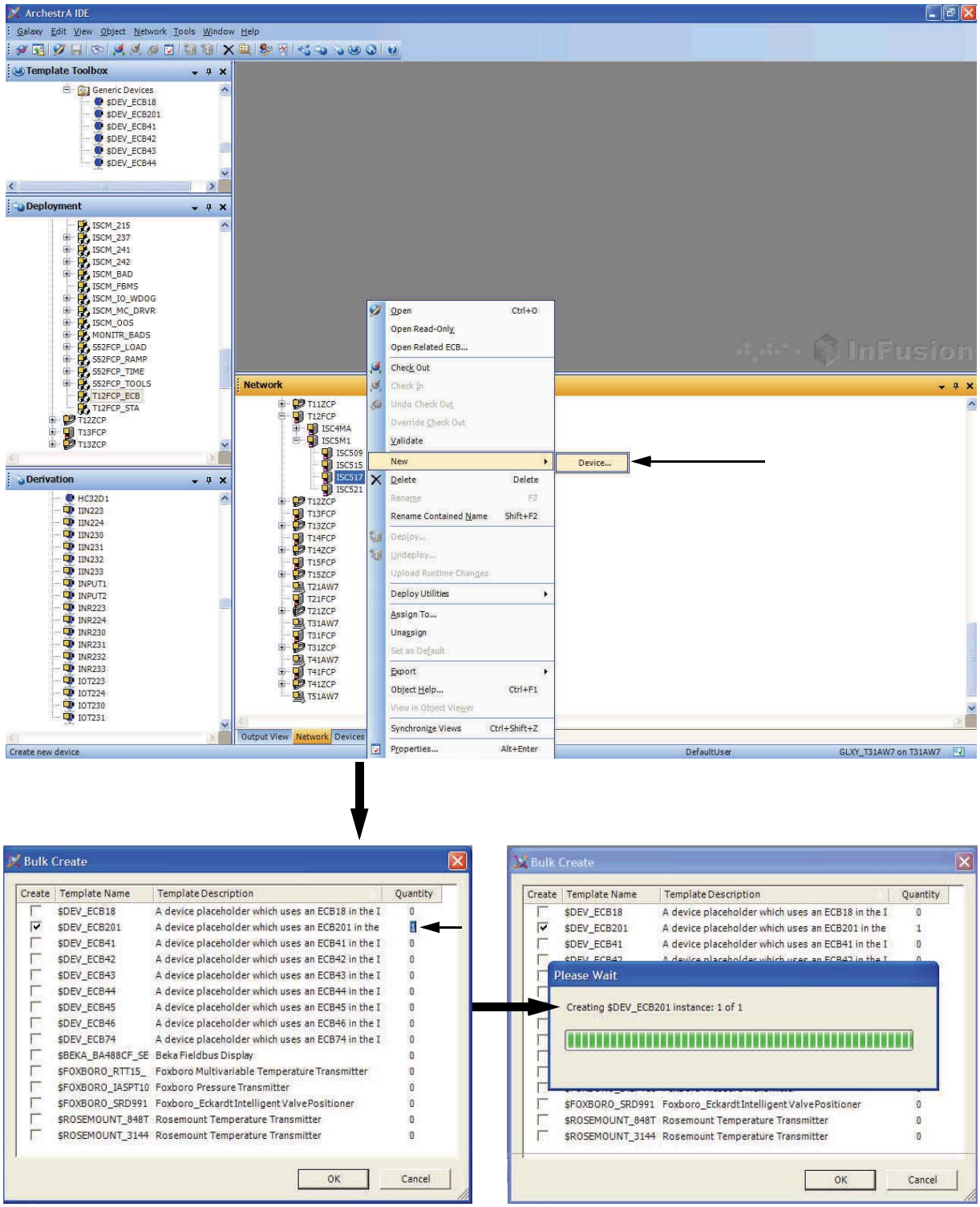


Figure 4-26. Creating an ECB201 for an LB 3102 (HART) Module's HART Device in IEE (Example)

Figure 4-27 shows how to rename an ECB201 for an LB 3102 module's HART device.

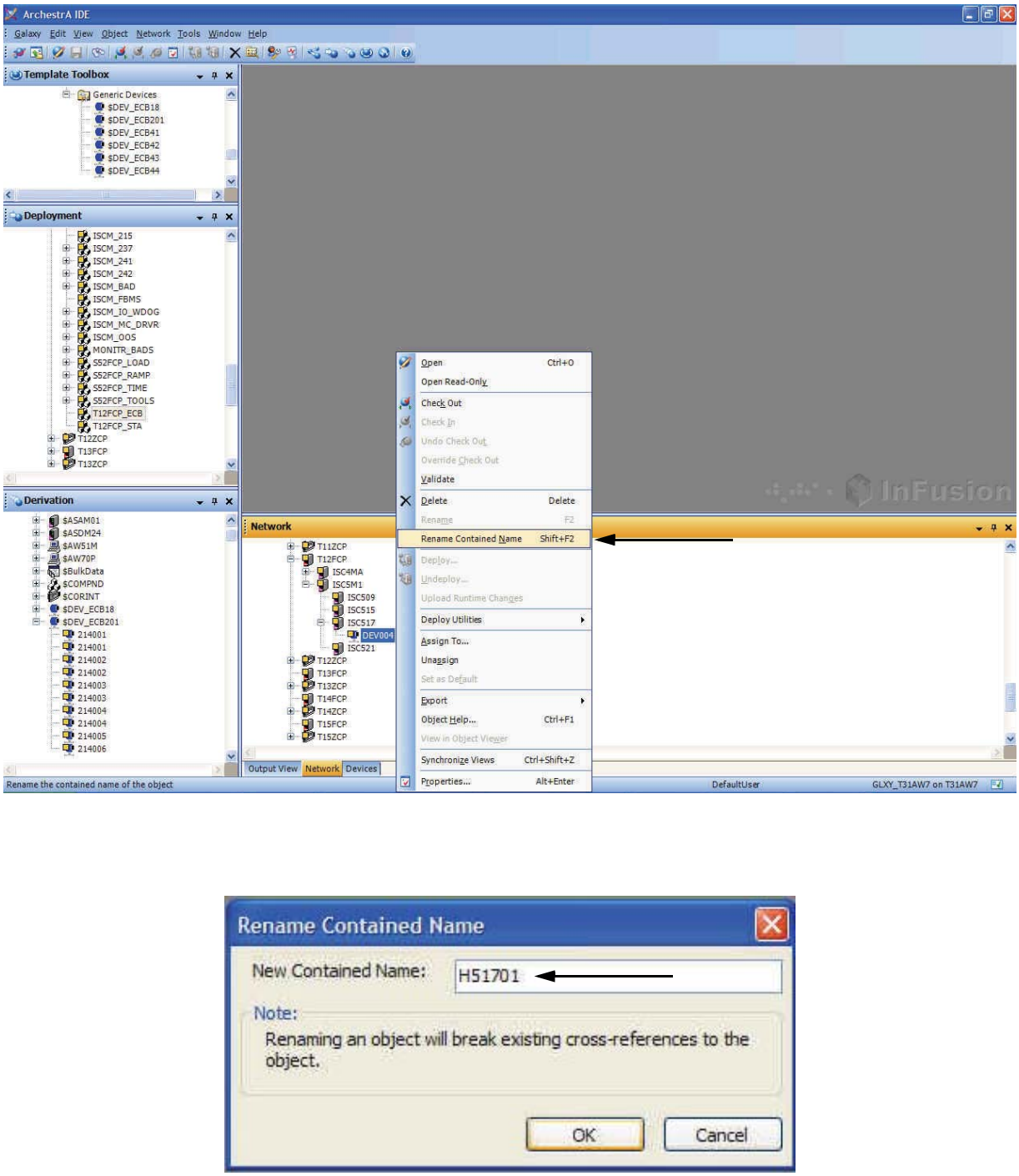


Figure 4-27. Renaming an ECB201 for an LB 3102 (HART) Module's HART Device in IEE (Example)

Figure 4-28 shows the Deployment View, General tab, for an ECB201 for an LB 3102 module's HART device, which allows you to configure several attributes of the ECB201.

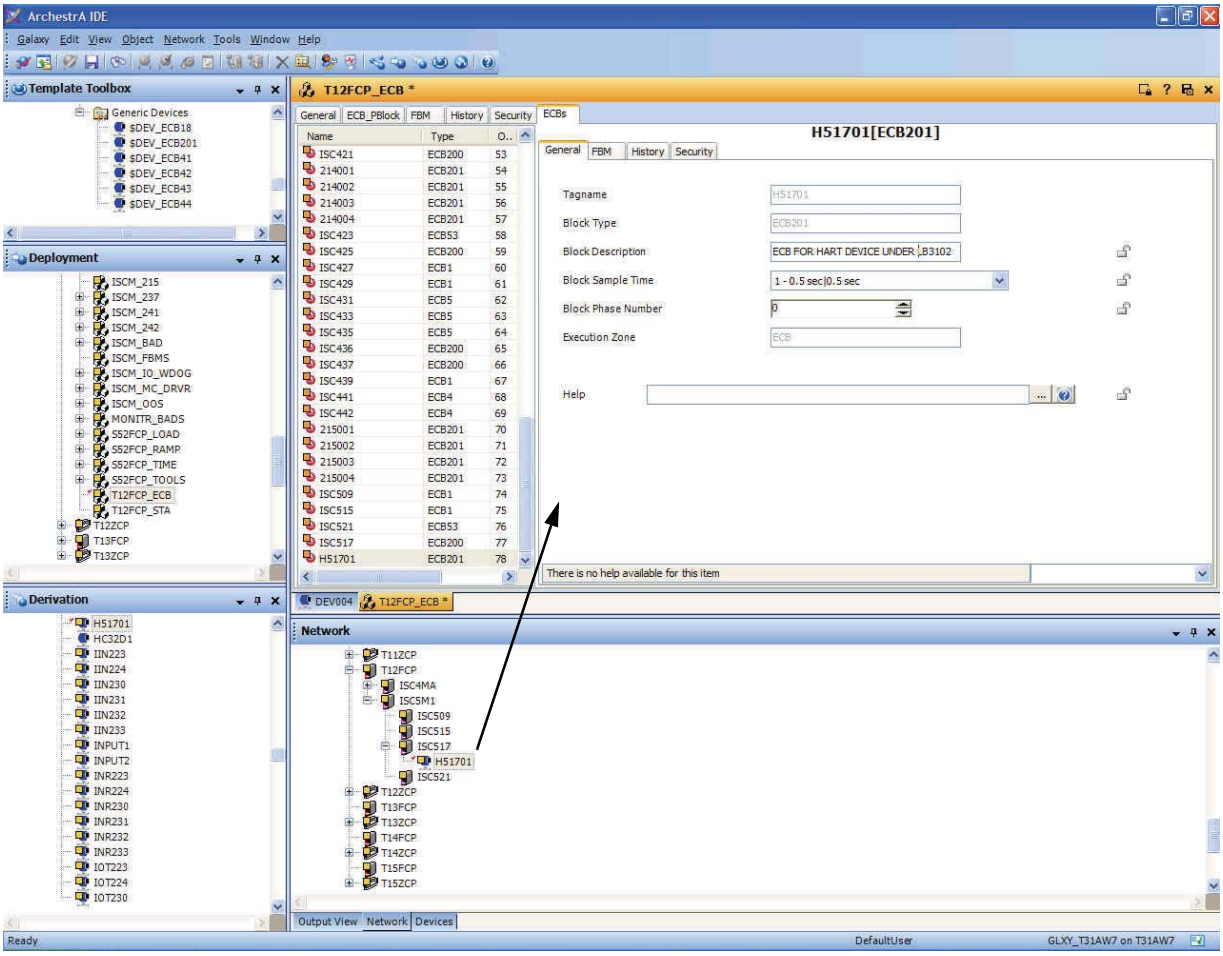


Figure 4-28. Configuring an ECB201 for an LB 3102 (HART) Module's HART Device in IEE Deployment View, General Tab (Example)

Figure 4-22 shows the Deployment View, FBM tab, for an ECB201 for an LB 3102 module's HART device, which allows you to configure several attributes of the ECB201.

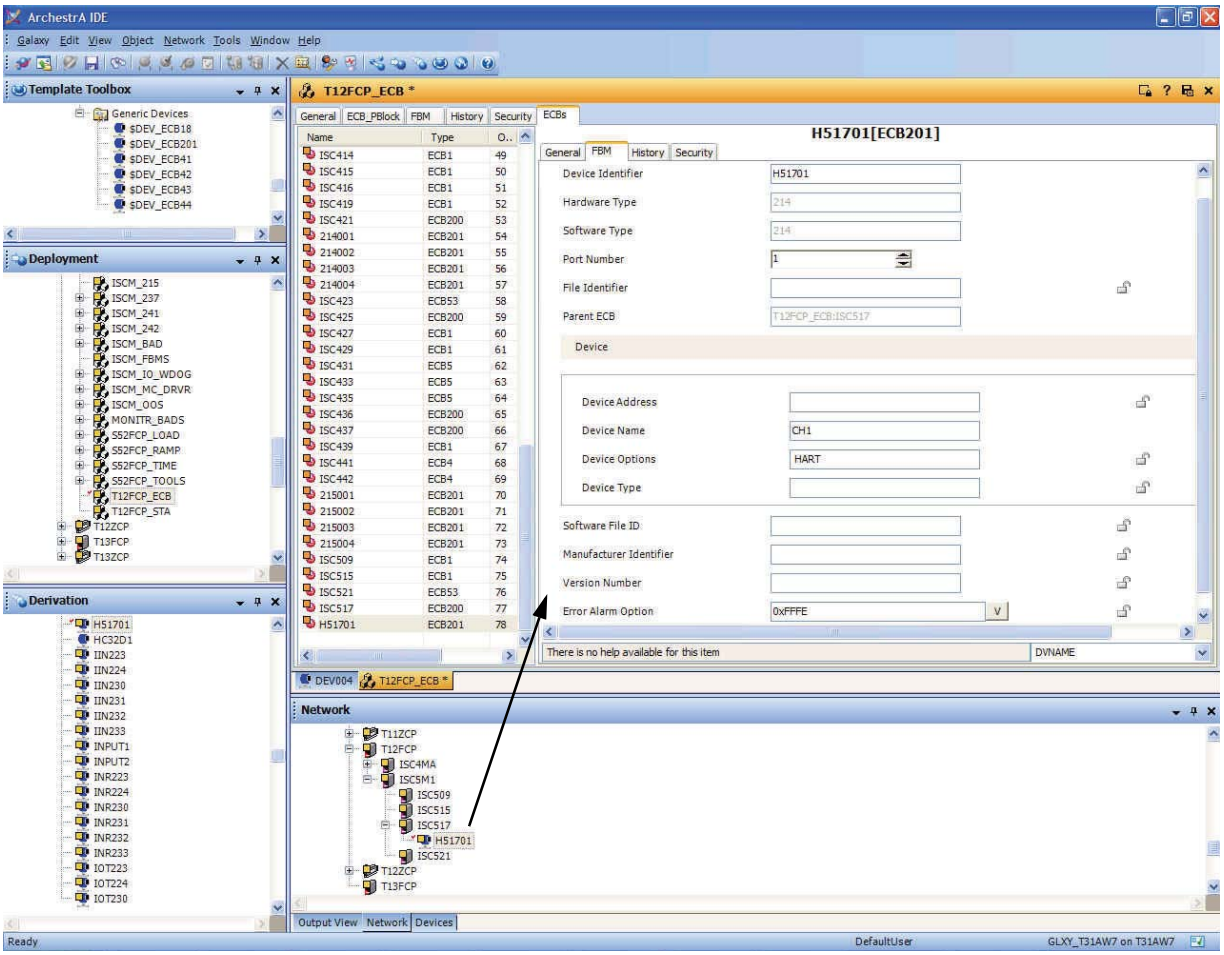


Figure 4-29. Configuring an ECB201 for an LB 3102 (HART) Module's HART Device in IEE Deployment View, FBM Tab (Example)

I/A Series Blocks for Supported FB-Style I/O Modules

Table 4-5 lists the appropriate Equipment Control Blocks (ECBs) and I/O blocks for use in conjunction with the Zone 1 I/O modules (FB-style), the module type codes that can be configured in BUSWDS.

Table 4-5. I/A Series Blocks for Supported Zone 1 IS/IO Modules

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (BUSWDS)	I/O Block
FB 1201 B	Digital Input	207	5	5	0x12	CIN, MCIN
FB 1203 F	Frequency + direction of rotation	206[1]	4	4	0x93	AIN
FB 1204 F	Pulse count + direction of rotation	206[1]	4	4	0x94	AIN, ACCUM
FB 1203 FL	Frequency low + direction of rotation	206[1]	4	4	0x93	AIN
FB 1204 FL	Pulse count low + direction of rotation	206[1]	4	4	0x94	AIN, ACCUM
FB 1208 B	Digital Input	207	5	5	0x18	CIN, MCIN
FB 1301 B FB 1301 B200[2]	Increased safety (NON IS) Digital Input	207	5	5	0x11	CIN, MCIN
FB 1303 F FB 1303 F2[2]	Frequency + direction of rotation	206[1]	4	4	0x93	AIN
FB 1303 FL FB 1303 FL2[2]	Frequency low + direction of rotation	206[1]	4	4	0x93	AIN
FB 1304 F FB 1304 F2[2]	Pulse count + direction of rotation	206[1]	4	4	0x94	AIN, ACCUM
FB 1304 FL FB 1304 FL2[2]	Pulse count low + direction of rotation	206[1]	4	4	0x94	AIN, ACCUM
FB 1308 B FB 1308 B200[2]	Digital Input	207	5	5	0x18	CIN, MCIN
FB 2201 B	DO with Position Feedback	241	5	5	0x21	CIN, MCIN, COUT, MCOUT
FB 2201 E	DO with Position Feedback + shutdown input	241	5	5	0x21	CIN, MCIN, COUT, MCOUT
FB 2202 B	DO with Position Feedback	241	5	5	0x22	CIN, MCIN, COUT, MCOUT

Table 4-5. I/A Series Blocks for Supported Zone 1 IS/IO Modules (Continued)

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (BUSWDS)	I/O Block
FB 2203 B	DO with Position Feedback	241	5	5	0x23	CIN, MCIN, COUT, MCOUT
FB 2203 E	DO with Position Feedback + shut-down input	241	5	5	0x23	CIN, MCIN, COUT, MCOUT
FB 2204 B	DO with Position Feedback	241	5	5	0x24	CIN, MCIN, COUT, MCOUT
FB 2205 B	DO with Position Feedback	241	5	5	0x25	CIN, MCIN, COUT, MCOUT
FB 2205 E	DO with Position Feedback + shut-down input	241	5	5	0x25	CIN, MCIN, COUT, MCOUT
FB 2212 B	DO with Position Feedback	241	5	5	0x2c	CIN, MCIN, COUT, MCOUT
FB 2212 E	DO with Position Feedback + shut-down input	241	5	5	0x2c	CIN, MCIN, COUT, MCOUT
FB 2213 B	DO with Position Feedback	241	5	5	0x2d	CIN, MCIN, COUT, MCOUT
FB 2213 E	DO with Position Feedback + shut-down input	241	5	5	0x2d	CIN, MCIN, COUT, MCOUT
FB 3204 B	Transmitter power	201	1	1	0x34	AIN, MAIN
FB 4204 B	Analog Output	237	53	53	0x44	AOUT; AIN to output
FB 5201 F3	3 wire RTD input	203	1	1	0xd1	AIN, MAIN
FB 5201 F4	4 wire RTD input	203	1	1	0xd1	AIN, MAIN
FB 5202 F	T/C with internal/external CJC RTD input	202	1	1	0xd2	AIN, MAIN
FB 5204 F3	3 wire RTD input	203	1	1	0xd4	AIN, MAIN
FB 5204 F4	4 wire RTD input	203	1	1	0xd4	AIN, MAIN
FB 5205 F	T/C with internal CJC RTD	202	1	1	0xd5	AIN, MAIN
FB 5206 B	0 - 10 V input	201	1	1	0x56	AIN, MAIN
FB 6301 H200	Digital Relay Output (230 V/24 V)	242	5	5	0x61	COUT, MCOUT; CIN/ MCIN to output

Table 4-5. I/A Series Blocks for Supported Zone 1 IS/IO Modules (Continued)

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (BUSWDS)	I/O Block
FB 6305 B200	Digital Relay Output	242	5	5	0x65	COUT, MCOUT; CIN/ MCIN to output
FB 6306 B FB 6306 B200[2]	Digital Relay Output	242	5	5	0x66	COUT, MCOUT; CIN/ MCIN to output
FB 6208 B	20V/8mA DO per channel, with shut-down input	242	5	5	0x68	COUT, MCOUT; CIN/ MCIN to output
FB 6210 B	Solenoid driver uses boost power	242	5	5	0x6a	COUT, MCOUT; CIN/ MCIN to output
FB 6210 E	Solenoid driver uses boost power+ shutdown input	242	5	5	0x6a	COUT, MCOUT; CIN/ MCIN to output
FB 6211 B	Solenoid driver use boost power	242	5	5	0x6b	COUT, MCOUT; CIN/ MCIN to output
FB 6211 E	Solenoid driver uses boost power+ shutdown input	242	5	5	0x6b	COUT, MCOUT; CIN/ MCIN to output
FB 6212 B	Solenoid driver uses boost power	242	5	5	0x6c	COUT, MCOUT; CIN/ MCIN to output
FB 6212 E	Solenoid driver uses boost power+ shutdown input	242	5	5	0x6c	COUT, MCOUT; CIN/ MCIN to output
FB 6213 B	Solenoid driver uses boost power	242	5	5	0x6d	COUT, MCOUT; CIN/ MCIN to output
FB 6213 E	Solenoid driver uses boost power+ shutdown input	242	5	5	0x6d	COUT, MCOUT; CIN/ MCIN to output
FB 6214 B	Solenoid driver uses boost power	242	5	5	0x6e	COUT, MCOUT; CIN/ MCIN to output
FB 6214 E	Solenoid driver uses boost power+ shutdown input	242	5	5	0x6e	COUT, MCOUT; CIN/ MCIN to output
FB 6215 B	Solenoid driver uses boost power	242	5	5	0x6f	COUT, MCOUT; CIN/ MCIN to output

Table 4-5. I/A Series Blocks for Supported Zone 1 IS/IO Modules (Continued)

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (BUSWDS)	I/O Block
FB 6215 ES	Solenoid driver uses boost power+ shutdown input	242	5	5	0x6f	COUT, MCOUT; CIN/ MCIN to output
FB 6308 FB 6308 B200[2]	20V/8mA DO per channel, with shut-down input	242	5	5	0x68	COUT, MCOUT; CIN/ MCIN to output

1. For the FBM206, the direction input will change the pulse count modules from up count to down count. Refer to the footnote on page 86.
2. This FB-style I/O module has front-mounted Ex-e connector with cable tails. A newer I/O module, listed above this I/O module in the same table cell, is available for this I/O module with a plug-in front EX-e connector instead of cable tails.

I/A Series Blocks for Supported FB-Style HART I/O Modules

Table 4-6 lists the appropriate Equipment Control Blocks (ECBs) and I/O blocks for use in conjunction with the Zone 1 HART I/O modules (FB-style), the module type codes that can be configured in SYSOPT.

Table 4-6. I/A Series Blocks for Supported Zone 1 HART IS/IO Modules

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (SYSOPT)	I/O Block
FB 3202 B	HART input with Transmitter power (16.5V)	214	200 and one 201	214	0x32	IIN, RIN, STRIN, PAKIN
FB 3205 B	HART and Trans-mitter power	214	200 and four 201s	214	0x35	IIN, RIN, STRIN, PAKIN
FB 3302 B FB 3302 B200[1]	HART input with Transmitter power (16.5V)	214	200 and one 201	214	0x32	IIN, RIN, STRIN, PAKIN
FB 3305 B FB 3305 B200[1]	HART and Trans-mitter power	214	200 and four 201s	214	0x35	IIN, RIN, STRIN, PAKIN
FB 4202 B	HART output	215	200 and one 201	215	0x42	IIN, ROUT, RIN, STRIN, PAKIN

Table 4-6. I/A Series Blocks for Supported Zone 1 HART IS/IO Modules (Continued)

P+F Model No.	Description	Hardware Type	ECB	Software Type	Type (SYSOPT)	I/O Block
FB 4202 C	HART output with shutdown input	215	200 and one 201	215	0x42	IIN, ROUT, RIN, STRIN, PAKIN
FB 4302 C FB 4302 C200[1]	HART output with shutdown input	215	200 and one 201	215	0x42	IIN, ROUT, RIN, STRIN, PAKIN
FB 4205 C	HART output with shutdown input	215	200 and four 201s	215	0x45	IIN, ROUT, RIN, STRIN, PAKIN
FB 4205 D	HART output with LFD	215	200 and four 201s	215	0x45	IIN, ROUT, RIN, STRIN, PAKIN
FB 4305 B FB 4305 B200[1]	HART® output with Ex-e	215	200 and four 201s	215	0x45	IIN, ROUT, RIN, STRIN, PAKIN

1. This FB-style I/O module has front-mounted Ex-e connector with cable tails. A newer I/O module, listed above this I/O module in the same table cell, is available for this I/O module with a plug-in front EX-e connector instead of cable tails.

I/O Point Configuration

The configuration of the I/O points for the P+F modules is similar to standard 200 Series FBMs, and is done by specifying the channel number in the PNT_NO parameter of the I/O blocks for all modules except HART modules. Refer to Table 4-7 for valid channel numbers for each of the supported modules:

Table 4-7. I/O Point Configuration for Supported P+F I/O Modules

Model(s)	Type	HWT	Input Point No.	Output Point No.
1x01	2 digital input	207	1 - 2	-
1x03	Frequency and direction input	206	1 - 2[1]	-
1x04	Pulse count and direction input	206	1 - 2[1]	-
1x08	8 digital input	207	1 - 8	-
2x01-2x13	2 digital input, 1 digital output	241	1 - 2	9
3x02	1 HART input	214	CH1[2]	-

Table 4-7. I/O Point Configuration for Supported P+F I/O Modules (Continued)

Model(s)	Type	HWT	Input Point No.	Output Point No.
3x04	4 current input	201	1 - 4	-
3x05	4 HART input	214	CH1 - CH4[2]	-
4x02	1 HART output	215	CH1[2]	CH1[2]
4x04	4 current output	237	-	1 - 4
4x05	4 HART output	215	CH1 - CH4[2]	CH1 - CH4[2]
5x01	1 RTD input	203	1	-
5x02	1 thermocouple input with CJC	202	1 and 9[3]	-
5x04	4 RTD input	203	1 - 4	-
5x05	4 thermocouple input with CJC	202	1 - 4 and 9[3]	-
5x06	1 voltage input	201	1	-
6x01	2 relay output	242	-	9 - 10
6x05	4 relay output	242	-	9 - 12
6x06	8 relay output	242	-	9 - 16
6x08	8 digital output	242	-	9 - 16
6x10-6x15	4 digital output	242	-	9 - 12

1. The direction input will change the pulse count modules from up count to down count, which will confuse the logic of the ACCUM block if the input is set to count down. If the ACCUM block is to be used, the direction input must be permanently set to a logical 1 to ensure that the module only counts in the up direction. If it is desired to use the direction input, then the ACCUM block cannot be used to accumulate pulse counts. A CALC block could be used instead to perform that function to take into account the state of the direction input which is available in the RAWC parameter of an AIN block connected to channel 2. The direction input for the 1x03 frequency input module has no affect on the frequency reading of the module. This input may be used as a digital input but state transitions of this input are not recorded by the module until there has also been a state transition on the channel 1 input.
2. CH1 - CH4 are set in the device ECB201 parameter DVNAME to specify the I/O channel number. The DVOPTS parameter can be set to **4-20** to use the channel with a current only device. **HART** or **NOALARM** may be specified when the channel is to be used with a HART device. If set to **NOALARM**, system alarms will be suppressed if there is a HART communication fault. RIN and ROUT blocks support the **CURRENT** parameter which represents the analog input or output current. RIN blocks support additional HART parameters listed in Table 4-9 below when a HART device is attached and enabled.
3. CJC (Cold Junction Compensation) is available for the P+F modules that support thermocouples. These values are brought into the I/A Series system as a channel 9 reading so that no special configuration of the AIN blocks is needed to compensate thermocouple readings. If desired, the CJC temperature reading may be configured to its own AIN block by using **SCI=43** and **PNT_NO=9**.

HART Device Variable Configuration

Each DCI block used in conjunction with HART devices contains at least one parameter, which specifies a point address in the field device (see Table 4-8). This point address indicates, to the HART device, the specific data I/O operation (command) to be performed (see Table 4-9). The I/O modules which are analogous to the HART FBMs support the HART universal commands. For specific commands supported by HART devices, refer to literature from the device manufacturer.

The values returned by HART devices depend on the dynamic variables they support. For example, in response to a "Read Dynamic Variables and P.V. Current" command (PVCURR), some devices return data only for the variables they support. Other devices return data for all four possible dynamic variables supported by the HART protocol, with the data for unused variables being zero.

The ISCM knows that a variable is unused only if the device does not return a value for it. For such (unused) variables, the data is marked out of service (OOS).

When the device returns a value (such as 0) for unused variables, the ISCM treats this value as good (not OOS) because it has no way of knowing that the variable is unused. In this case, you are responsible for knowing that data for unused variables is invalid.

⚠ CAUTION

Make sure to know what dynamic variables your HART devices support. Only with this knowledge can you know when a seemingly good value is invalid because it is associated with an unused variable.

Table 4-8. DCI Block Parameters Requiring a Point Address

DCI Block	Connection Parameter(s) to be Configured
RIN	PNT_NO
ROUT	PNT_NO
IIN	PNT_NO
PAKIN	PKINGP
STRIN	PNT_NO

Table 4-9. Point Address Values for DCI Blocks

Point Address[1]	Description	DCI Block	Signal Condition Index	Device Type
CURRENT	Current (analog input current value)	RIN	SCI = 1-10	Input
CURRENT	Current (analog output current value)	ROUT	SCO = 1-5	Output
PV	Primary Variable	RIN	SCI = 0	Input
PVUNITS	Primary Variable Units	STRIN	----	Input
PVCURR	Primary Variable Current	RIN	SCI = 0	Input

Table 4-9. Point Address Values for DCI Blocks (Continued)

Point Address[1]	Description	DCI Block	Signal Condition Index	Device Type
SV	Secondary Variable	RIN	SCI = 0	Input
SVUNITS	Secondary Variable Units	STRIN	----	Input
TV	Tertiary Variable	RIN	SCI = 0	Input
TVUNITS	Tertiary Variable Units	STRIN	----	Input
FV	Fourth Variable	RIN	SCI = 0	Input
FVUNITS	Fourth Variable Units	STRIN	----	Input
DEVSTS (See below)	HART Device Status	IIN	----	Input
STATUS1[2]	Command 48 Status, Bytes 4-1	PAKIN	----	Input
STATUS2[2]	Command 48 Status, Bytes 8-5	PAKIN	----	Input
STATUS3[2]	Command 48 Status, Bytes 12-9	PAKIN	----	Input
STATUS4[2]	Command 48 Status, Bytes 16-13	PAKIN	----	Input
STATUS5[2]	Command 48 Status, Bytes 20-17	PAKIN	----	Input
STATUS6[2]	Command 48 Status, Bytes 24-21	PAKIN	----	Input
STATUS7[2]	Command 48 Status, Byte 25	PAKIN	----	Input

1. For standard 4 to 20 mA analog I/O devices (not HART devices), use point address CURRENT.
2. Discussed in “Additional Device Status (Status1-Status7)” on page 89.

DEVSTS is an 8-bit value that contains the device diagnostic status reported by a field device. See Table 4-10. This information is also available in the low 8-bits of the ECB201 DDIAG1 parameter, discussed in *Integrated Control Block Descriptions Volume 2 of 3, ECB – MOVLV* (B0193AX).

Table 4-10. DEVSTS Bit Value Definitions[1]

Bit 0: 1 = PV Out-of-Limits
Bit 1: 1 = Non-PV Out-of-Limits
Bit 2: 1 = PV Analog Output Saturated
Bit 3: 1 = PV Analog Output Fixed
Bit 4: 1 = More Status Available
Bit 5: 1 = Cold Start
Bit 6: 1 = Configuration Changed
Bit 7: 1 = Field Device Malfunction[2]

1. Bit 0 is the least significant, low-order bit.
2. This bit causes the device icon in SMDH to turn yellow and sets the I/O BAD bit for blocks connected to the device.

Additional Device Status (Status1-Status7)

The 25-byte "additional status" value is accessible with standard DCI input blocks. All twenty-five bytes can be read in groups of 32 bits using the PAKIN block with PKIOPT set to 3, displayed in most significant to least significant order, as shown below

Bytes	Configure PKINGP	Example
4 - 1	STATUS1	04 03 02 01
8 - 5	STATUS2	08 07 06 05
12 - 9	STATUS3	12 11 10 09
16 - 13	STATUS4	16 15 14 13
20 - 17	STATUS5	20 19 18 17
24 - 21	STATUS6	24 23 22 21
25	STATUS7	00 00 00 25

Be aware of the following with regards to the 25-byte "additional status" value:

- Not all devices provide additional status.
- A device that does provide additional status may not provide a full 25 bytes of additional status. For this reason, before the ISCM issues the first Command 48, the ISCM clears (sets to 0) the entire 25-byte storage area so that any unused bytes will not contain misleading ones (1s).
- The PKIOPT parameter of the PAKIN blocks must be set to 3 to avoid swapping of the bits and bytes. The default setting of this parameter is 1.
- The PAKIN block detail display shows the PAKCIN parameter as in the examples above, but the individual bits are displayed as most significant bit=1 (upper left) and least significant bit=32 (lower right). This means that the top line displays the bits in byte 4 and the bottom line displays the bits in byte 1.
  Bits 19 and 20 shown in Figure 4-30 that are a logical 1 reside in byte 2, bits 5 and 4 of the command 48 status reply message.

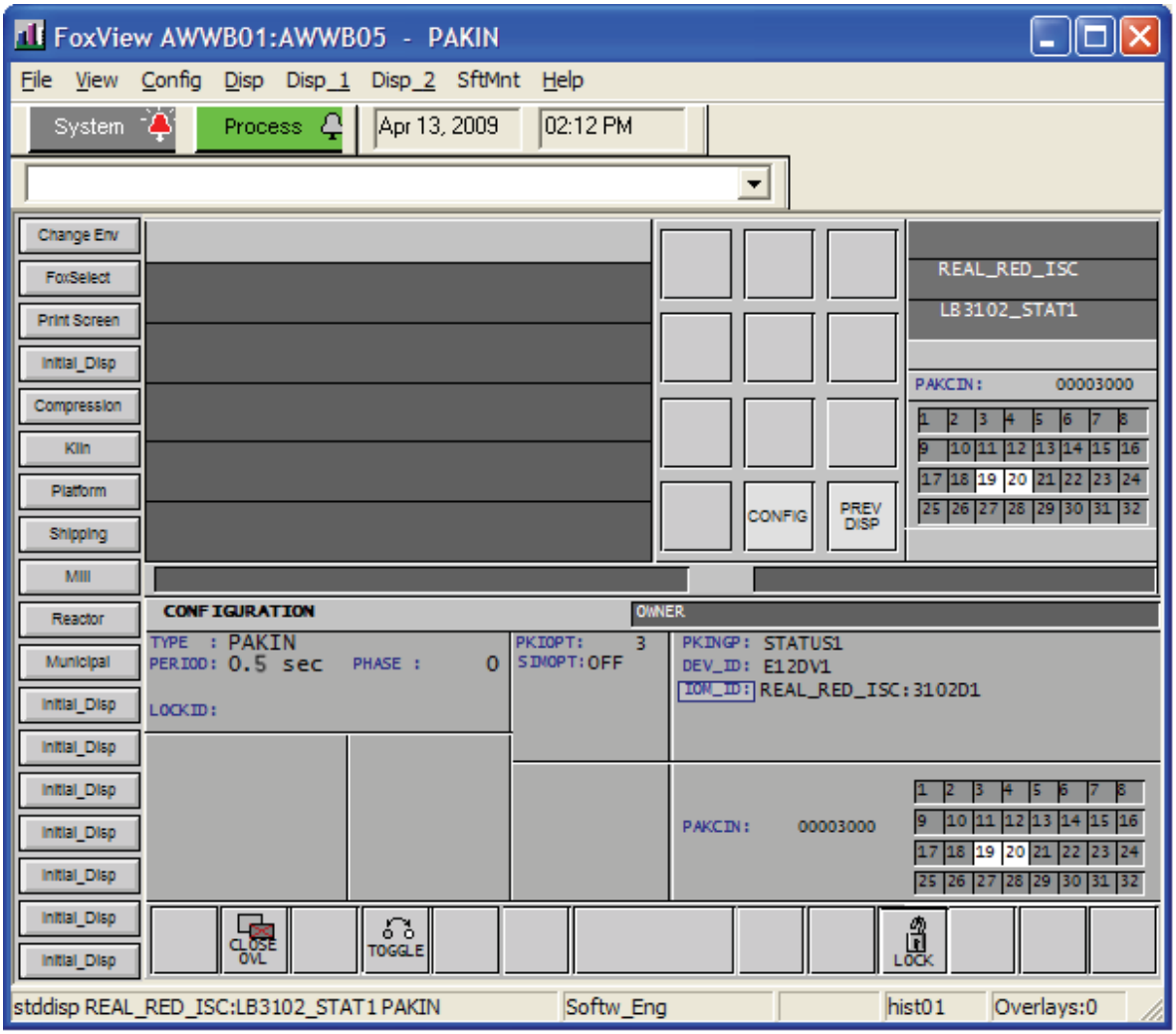


Figure 4-30. PAKIN Block Example

5. System Management

This chapter provides general system management information for the ISCM and its associated P+F intrinsically safe I/O modules. It also provides references to the manuals that describe the tools you use to perform in-depth system management tasks.

Overview

The general I/A Series system management philosophy applies to the ISCM and its associated P+F intrinsically safe I/O modules incorporated into the I/A Series system. Through the System Management Displays, you can receive status information on the ISCM and its I/O modules, as well as send change requests to the ISCM and its I/O modules.

System management for the ISCM is supported on the following system and display management packages:

- SMDH - discussed in *System Management Displays* (B0193JC)
- FoxView™ - discussed in *Process Operations and Displays* (B0700BN)
- System Manager - discussed in *System Manager* (B0750AP)
  This is part of InFusion View package, which has other packages for managing the ISCM, discussed in *InFusion View User's Guide, Control Edition* (B0750AQ).

The security of this system is maintained via the standard I/A Series control processor software and the customer-engineered user interface to the control block database. All access to the I/O data is through the control blocks. The end user has no direct access to any of the I/O functions or the data in the ISCM or attached I/O modules.

Operating Status

The operating status of the ISCM and its I/O modules is reported by the I/A Series system using on-screen and printed messages. Refer to the following documents for information on the reporting of equipment operating status and errors:

- *I/A Series System Management Displays* (B0193JC)
- *I/A Series System V8.x System Error Messages* (B0700AF)
- *I/A Series Process Operations and Displays* (B0700BN).

System Manager Displays for the ISCM and P+F I/O Modules

The System Manager allows you to access equipment information and status for an I/A Series system, including the ISCM and P+F I/O modules. This display reflects the system's current operating status and provide a valuable maintenance aid by allowing you to observe the current operating status of the various system elements and intervene in system operations. For information on navigating through the System Manager screens, see *System Manager* (B0750AP).

For information on viewing the ISCM runtime information in the InFusion View application, refer to *InFusion View User's Guide, Control Edition* (B0750AQ).

The System Manager display pages for the ISCM (Figure 5-1) and P+F I/O modules (Figure 5-2) contain operational status, hardware and software information.

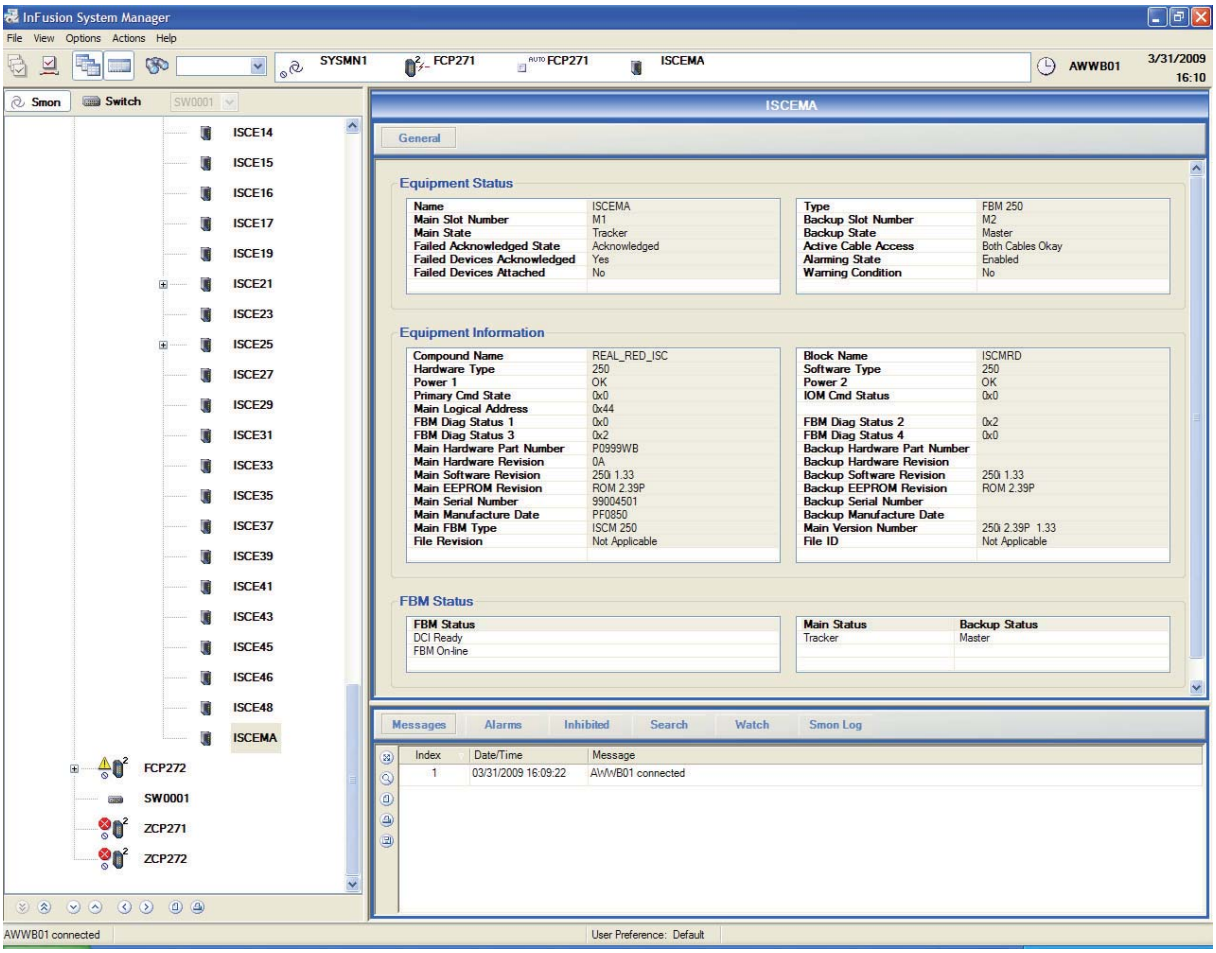


Figure 5-1. System Manager Display for ISCM - Typical

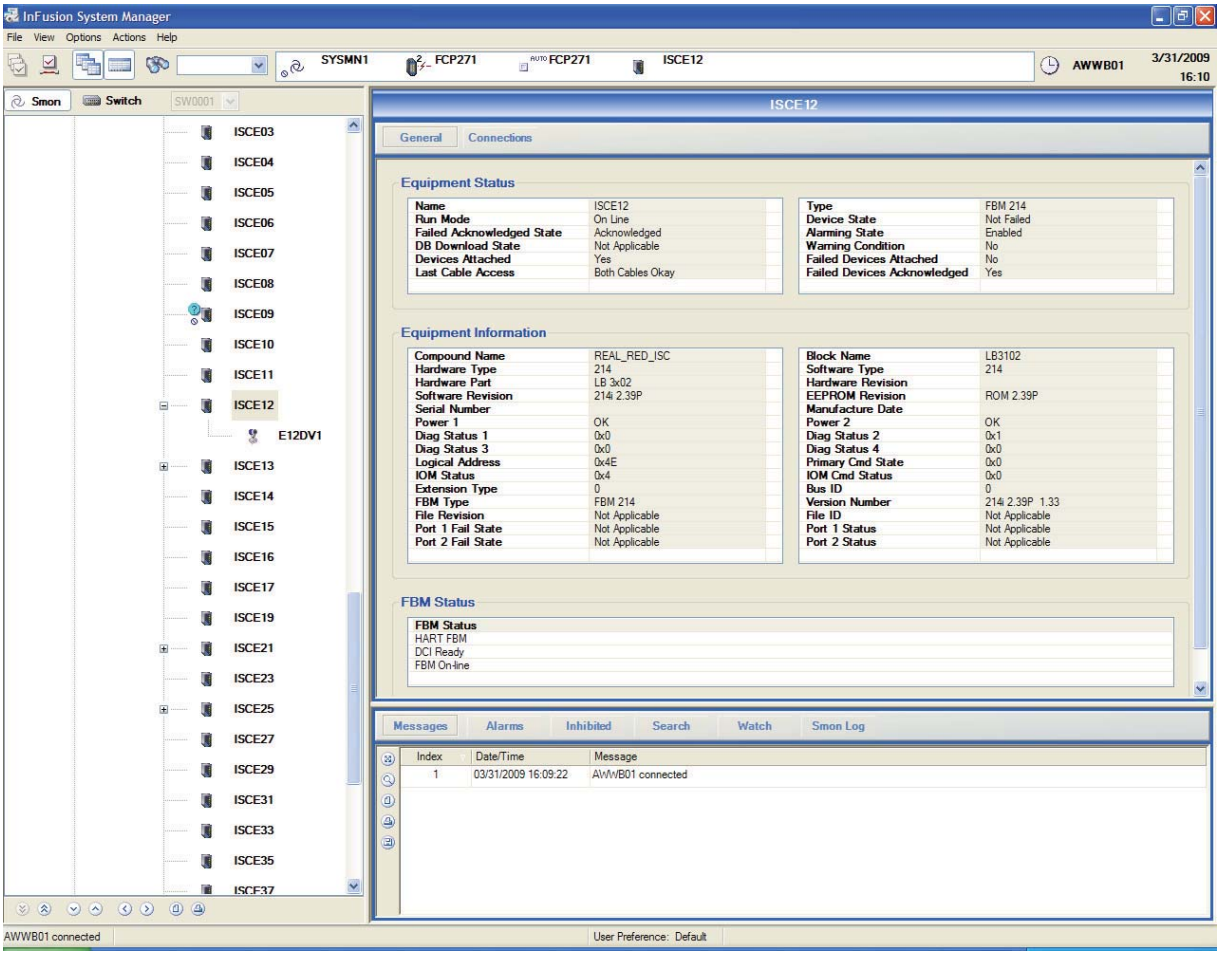


Figure 5-2. System Manager Display for P+F I/O Modules - Typical

Table 5-1 describes the available text fields for Equipment Status in the order that they appear on the display pages.

Table 5-1. InFusion Equipment Status Display Fields for ISCM and Intrinsically Safe I/O Modules

Field	Description
Name	Module letterbug assigned during definition of system hardware.
Type	Equivalent 200 Series FBM type for this P+F I/O module, and the number/type of inputs/outputs. In this example, 8AI indicates eight analog inputs. The type is defined when the ECB is assigned during the site planning and system definition phases. Note that P+F I/O modules have fewer I/O channels than the number indicated here.

Table 5-1. InFusion Equipment Status Display Fields for ISCM and Intrinsically Safe I/O Modules (Continued)

<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>Run Mode</td><td>On-line or Off-line (default) is displayed. (All ECBs are off-line by default once configured, and then must be turned on-line.) Set the RUN MODE using the GO ON-LINE and GO OFF-LINE options in the Equipment Change Display. If the I/O module automatically goes off-line:
♦ Check hardware
♦ Check related fields
♦ Download (restart) the I/O module.</td></tr>
<tr><td>Device State</td><td>Possible mutually exclusive states are:.

<table><tr><th>STATE</th><th>Description</th></tr><tr><td>On Scan</td><td>The module is connected to the control strategy, though measurements are not guaranteed to be good.</td></tr><tr><td>Comm Failures</td><td>No real module information is available.</td></tr><tr><td>Failed</td><td>Fatal hardware or other fatal fault reported by the module. This presupposes that communication has not failed.</td></tr><tr><td>Not Ready</td><td>Transition state. The module is healthy, and normal automatic startup procedures are bringing the device On Scan.</td></tr></table></td></tr>
<tr><td>Failed Acknowledged State</td><td>Acknowledged or Not Acknowledged. This field is initially set to Acknowledged. If the DEVICE STATE changes from Not Failed to Failed, the FAIL ACK STATE field changes to Not Acknowledged. Use the ACK key in the top menu bar of the Equipment Information display to acknowledge the selected faulted device; or use the ACK ALL key in the top menu bar of the initial System Management display to acknowledge all the unacknowledged devices for which the workstation has responsibility.</td></tr>
<tr><td>Alarming State</td><td>Enabled or Inhibited. This field indicates whether alarming for system alarms, not process alarms, is Enabled or Inhibited for the I/O module. When alarming is Inhibited, the System Monitor continues to indicate overall system and network health (a green “Sys” bar) while equipment is failed or off-line. Additionally, when alarming is inhibited, System Alarm messages are not logged to the system printer, nor the Historian.</td></tr>
<tr><td>DB Download State</td><td>Downloading or Not Downloading. This field is initially set to Not Downloading. When the station is rebooted via an operator-initiated request, the status changes to Downloading until the action is completed.</td></tr>
<tr><td>Warning Condition</td><td>Yes or No. If the device has a non-fatal error condition, it is indicated in this field.</td></tr>
</table>

Table 5-1. InFusion Equipment Status Display Fields for ISCM and Intrinsically Safe I/O Modules (Continued)

Field	Description
Devices Attached (HART modules only)	Yes or No. Yes is displayed if a HART I/O module has devices attached; otherwise No is displayed.
Failed Devices Attached (HART modules only)	Yes or No. Yes is displayed if a HART I/O module device is failed; otherwise No is displayed.
Last Cable Access	Possible values reflect the health of both cables (Both Cables OK, Cable A Not OK, Cable B Not OK, Both Cables Not OK). This field applies to the selected device and indicates whether transmissions were successfully sent the last time either Bus A or B was used.
Failed Devices Acknowledged	Acknowledged or Not Acknowledged. This field is initialized to Acknowledged. If any of the attached devices become unacknowledged, the field changes to Not Acknowledged. (HART only.)

Table 5-2 describes the available text fields for Equipment Information in the order that they appear on the display pages.

Table 5-2. InFusion Equipment Information Display Fields for ISCM and Intrinsically Safe I/O Modules

Field	Description
Compound Name	The control database compound name for the ECB associated with the I/O module.
Block Name	The control database name of the ECB associated with the I/O module.
Hardware Type	Number associated with the FBM type for the P+F I/O module. See Table 4-3 on page 58 and Table 4-5 on page 81.
Software Type	Indicates the type of application software (ECB) being used with the designated FBM hardware type. See the tables in “Intrinsically Safe I/O Module Configuration” on page 57.
Hardware Part	Invensys part number for the ISCM or the P+F Model number in the form of “LB 1x01” for LB 1101 or “FB 1x01” for FB 1201, for example.
Hardware Revision	Hardware revision number of the ISCM, blank for P+F I/O modules.
Software Revision	Module’s software revision number.
EEPROM Revision	EEPROM revision level.
Serial Number	Last 8 digits of P+F serial number for ISCM, blank for I/O modules
Manufacture Date	First 6 digits of P+F serial number for ISCM, blank for I/O modules
Power 1	OK or Failed indicates the state of power supplies on the base unit.
Power 2	OK or Failed indicates the state of power supplies on the extension unit.

Table 5-2. InFusion Equipment Information Display Fields for ISCM and Intrinsically Safe I/O Modules (Continued)

Field	Description
Diag Status 1	Diagnostic Status 1 is a bit mapped hexadecimal value related to the module power status. See Table 5-7 on page 115 for description of each of the bits.
Diag Status 2	Diagnostic Status 2 is a hexadecimal value indicating the module start-up condition. Hexadecimal values and the related conditions are as follows: **Value Condition** 1 - Power Fail Recovery (Power up) 2 - Download Recovery (Reset) 4 - Watchdog timer failure (ISCM only) 8 - Warm Reset (Off Line / On Line) If the module is operating normally, this field can be safely ignored.
Diag Status 3	Count of non-fatal errors logged by the ISCM, 0 for P+F I/O modules. If the module is operating normally, this field can be safely ignored. For resolution of the module hardware and software errors indicated by this diagnostic status field, call the IOM Global Customer Support Center.
Diag Status 4	Diagnostic Status 4 is a hexadecimal value relating to the current software or hardware error for the selected module. Normally, this value is 0 (no error). Other values are fatal errors; the module is not operational. Typical values and their meaning are as follows: **Value Condition** 0 - No error 15 - Hardware type mismatch (module installed in the wrong slot) 16 - Software type mismatch (ECB configuration error) ff - EEPROM update in progress (non-fatal indication) Corrective actions include: ♦ Installing the module in the correct slot ♦ Correcting ECB configuration errors ♦ Restarting the module using the DOWNLOAD function on the Equipment Change display ♦ Reloading the module software using the EEPROM UPDATE function. (ISCM only) If the above actions do not correct the problem, call the IOM Global Customer Support Center.
Logical Address	In an I/A Series system, FBM modules are displayed in alphabetical order by letterbug and are typically numbered beginning at 21. The FBM order is the order in which the FBMs were installed using the system/control configurator. However, if an FBM is deleted and another added later, the new FBM is given the lowest number available.

Table 5-2. InFusion Equipment Information Display Fields for ISCM and Intrinsically Safe I/O Modules (Continued)

Field	Description
Primary Cmd State	Primary Command Status is a value related to the status of communication between the I/O module acting as the primary FBM and this I/O module. Typically, this value is 0 or 1, where 1 indicates that a successful retry took place and communication has been restored to normal. Primary Command Status can have the following values: **Value Condition** 0 - Normal, no error 1 - Success with retry (this condition is very rare) 2 - FCM timed out I/O module (ZCP270 only) 3 - CP timed out FCM (ZCP270 only) > 3 - Link level protocol error (this is very rare and transient)
IOM Status	IOM Status is a hexadecimal value related to the current I/O module status. Typically this value is 4, indicating the instructions are valid. **Value Condition** 1 - Module status has changed – requests CP to poll for extended status. 2 - Diagnostic Register is nonzero. This indicates a fatal error. The module does not start if this value is set. 4 - Non-fail-safe condition. This is the typical status for a module that is on-line. This value is reset only if the outputs of the module are in fail-safe. 40 - Module is off-line. In off-line mode, the I/O is unavailable for control. 80 - Initialization is taking place – all channel and I/O data is initializing. Also, indicates that the module has a delayed response message ready.
IOM Cmd Status	IOM Command Status is a hexadecimal value associated with the return status included in the header of every response from this I/O module to the I/O module acting as the primary FBM. Typically, the hexadecimal value is 0, indicating the command was understood and action was taken. **Value Condition** 1 - Command not understood. 2 - Command understood, but unable to take action. 4 - Invalid argument.
Extension Type	Not applicable to P+F I/O modules. (Always 0)
Bus ID	Not applicable to P+F I/O modules.

Table 5-2. InFusion Equipment Information Display Fields for ISCM and Intrinsically Safe I/O Modules (Continued)

Field	Description
FBM Status	(ISCM or HART I/O Card only) The following may be displayed to define the FBM status: FBM On-Line DCI Not Ready FBM Off-Line DCI Ready Unresolved Connection I/O Module Failed System Alarm
Main Status and Backup Status	The following may be displayed for the redundant ISCM stations: Master, Tracker, Failed, Off-line, Not operational.

LB 1108 A Intrinsically Safe I/O Module Alarm Generation

Intrinsically safe I/O modules with line fault detection can result in an I/O BAD indication and a system alarm. Refer to “Line Fault Detection and Bad I/O Alarming” on page 25 for details.

System Manager Equipment Change Actions for ISCM and P+F I/O Modules

Equipment change actions for the ISCM and I/O modules in the System Manager are available through the `Actions` > `Equipment Change` submenu, or by right-clicking the FBM icon. Refer to "Equipment Change Actions" in *System Manager* (B0750AP) for details.

Equipment Change Display for ISCM

The Equipment Change display for the ISCM is shown in Figure 5-3. The actions that are active for this display are described in Table 5-3.

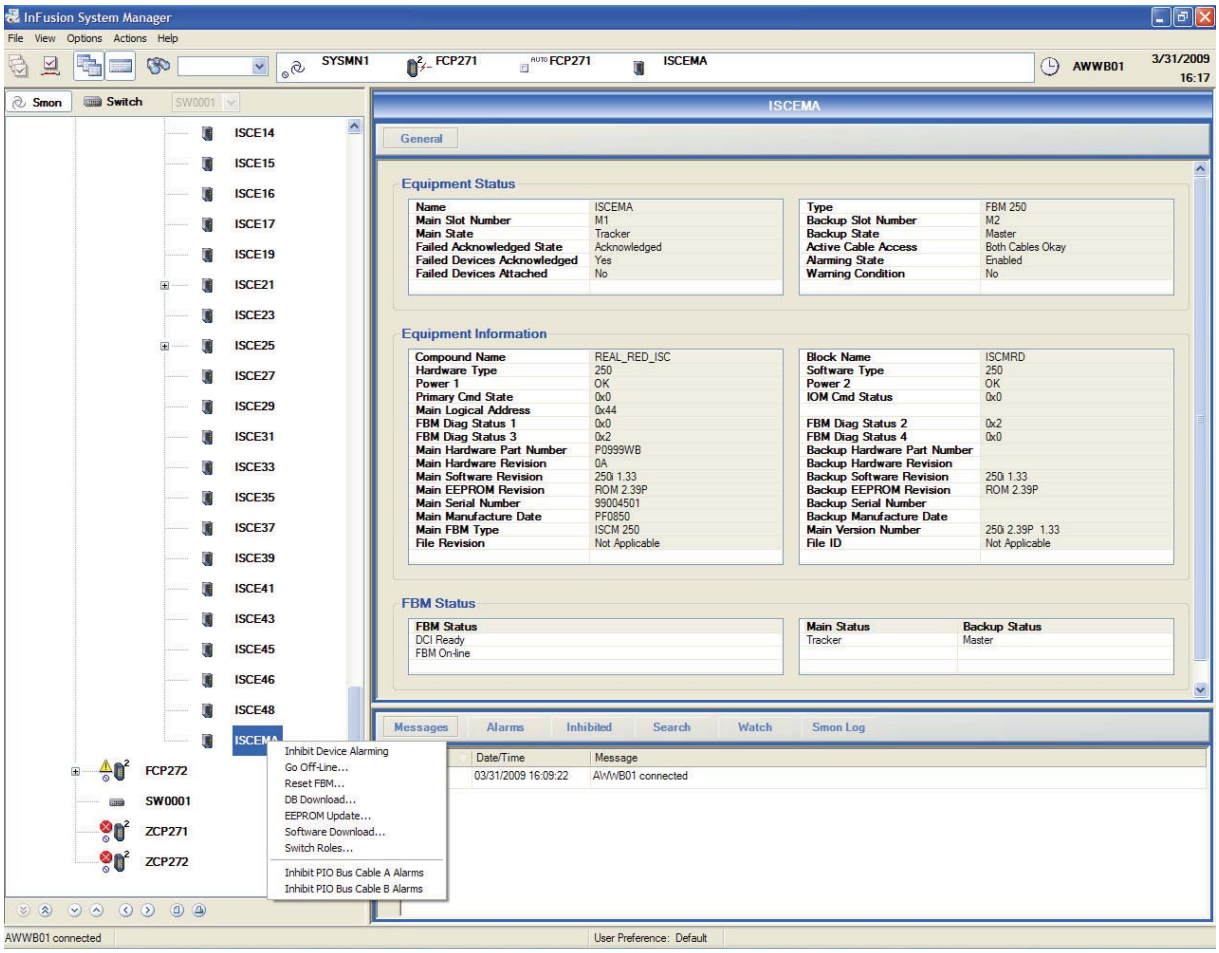


Figure 5-3. Equipment Change Actions for ISCM

Table 5-3. System Manager Equipment Change Display Fields for ISCM

Field	Description
Enable Device Alarming	Allows ISCM device (system) alarms to propagate upward in the I/A Series system.
Inhibit Device Alarming	Inhibits ISCM device (system) alarms from propagating upward in the I/A Series system.

Table 5-3. System Manager Equipment Change Display Fields for ISCM (Continued)

Field	Description
Go On-line...	Puts the ISCM on-line and readies it to communicate with the P+F I/O modules that are attached.
Go Off-Line...	Puts the ISCM off-line. This terminates all communications for the attached I/O modules and causes them to invoke their fail safe conditions (hold or fallback). The attached I/O cards all show a communications failure when the ISCM is off-line. See the NOTE below.
Reset FBM...	Reboots the ISCM by resetting the hardware. This causes a complete reinitialization of the data structures of the ISCM and the I/O modules (configuration database). The I/O modules invoke their fail-safe conditions (hold or fallback). The attached I/O modules all show a communications failure until the ISCM is back on-line and the communications have been reestablished with each I/O module. See the NOTE below.
DB Download...	n/a - Performs no action for the ISCM
EEPROM Update...	Puts the ISCM off-line and downloads a new image to the flash ROM to be burned. Once the burn is complete, the ISCM's new software is downloaded to begin execution of the new image. During this operation, all communications with the attached I/O modules is terminated and fail-safe conditions (hold or fallback) are invoked. See the NOTE below.
Software Download...	n/a - Performs no action for the ISCM
Switch Roles... (redundant ISCMs only)	Allows the ISCMs exchange mastership. See the NOTE below.

NOTE

"**Go Off-Line...**", "**Reset FBM...**" and "**EEPROM Update...**" of an ISCM that is redundant and has its partner on-line will maintain all communication with the I/O modules during these operations. For this reason, do not perform this operation on both ISCMs at the same time. Wait until the operation has completed on one ISCM and it comes back on-line before performing the operation on the other module. It is also recommended that you do not perform the operation on the Master ISCM without first using the "Switch Roles" command to first make it the Tracker. Performing these operations on the Master ISCM could result in a temporary loss of communication with one or more of the I/O modules.

Refer to "EEPROM Update Procedure for Redundant ISCMs" on page 101 for the EEPROM update procedure.

EEPROM Update Procedure for Redundant ISCMs

The ISCMs are shipped with the latest software already installed. However, if a software upgrade is recommended by Invensys, use the following procedure to EEPROM update the redundant ISCMs to avoid any interruption of the communication to the I/O modules:

1. Ensure both ISCMs are on-line. The state of each ISCM is indicated in the FBM Status pane at the bottom. This will show that the Main Status is Master (or Tracker) and the Backup Status is Tracker (or Master). In addition, the Warning Condition for the ISCM will be "**No**".
2. EEPROM update the ISCM that is shown as Tracker. During the update the status will indicate "Off Line". Do not perform any other action until the ISCMs are both again on-line.
3. Once the ISCM is back on-line, use **Switch Roles** to make the updated module the Master. Wait until this state change is indicated in the FBM status.
4. EEPROM update the other ISCM that is now shown as Tracker. During the update, the status will indicate "Off Line". Do not perform any other action until the ISCMs are both again on-line.
5. Do not EEPROM update the I/O modules as the ISCM update takes care of all of the I/O modules. However, if this action is performed, it will do no harm and have the same effect as the Download action.

Equipment Change Display for P+F I/O Modules

The Equipment Change display for the P+F I/O modules is shown in Figure 5-4. The actions that are active for this display are described in Table 5-4.

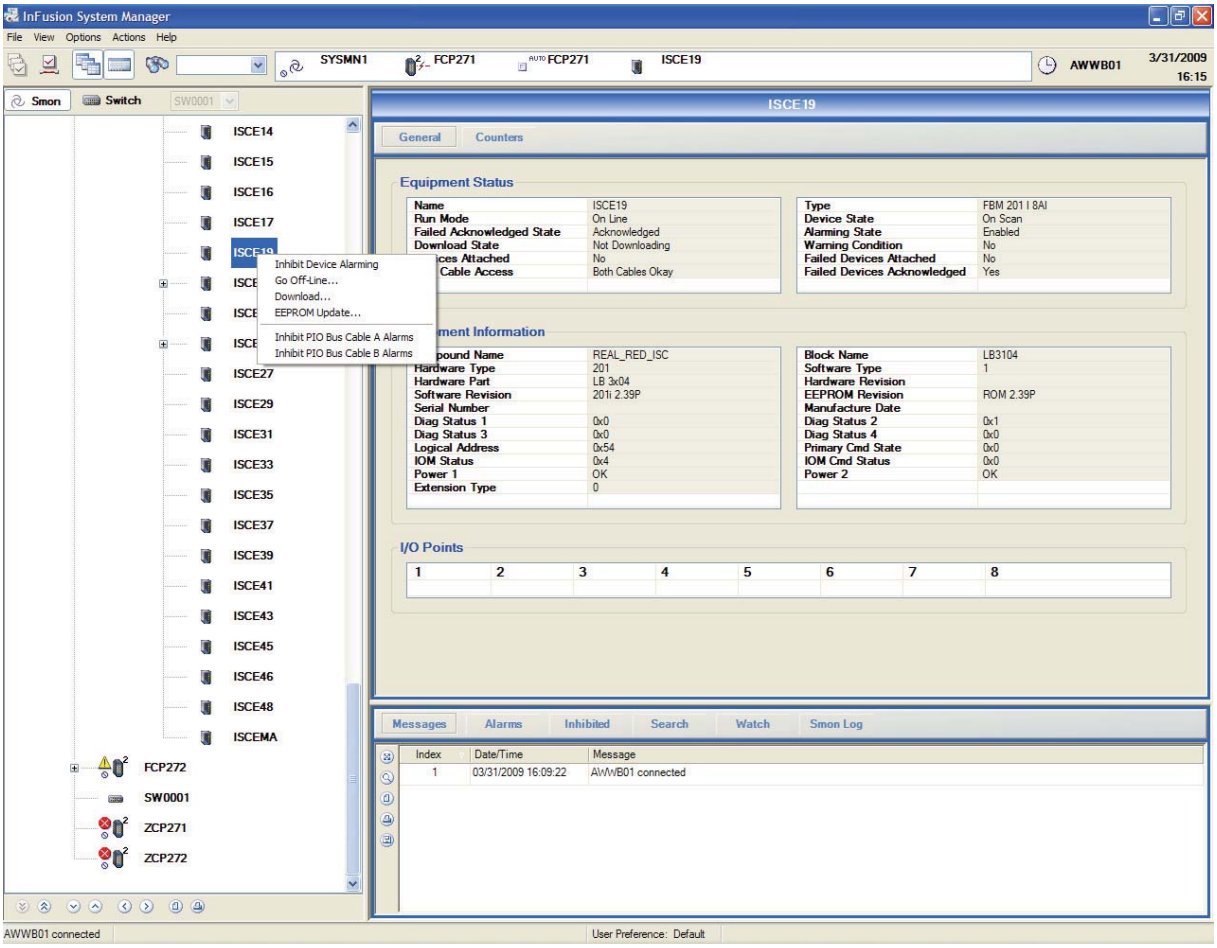


Figure 5-4. Equipment Change Actions for I/O Modules

CAUTION

Only designated personnel who are aware of the effects of making equipment changes should initiate equipment changes.

Table 5-4. Equipment Change Display Fields for P+F I/O Modules

Field	Description
Enable Device Alarming	Allows device (system) alarms to propagate upward in the I/A Series system to the FCP/ZCP.
Inhibit Device Alarming	Inhibits device (system) alarms from propagating upward in the I/A Series system to the FCP/ZCP.

Table 5-4. Equipment Change Display Fields for P+F I/O Modules

Field	Description
Go On-line	Connects the I/O module to the I/A Series control processor, thus enabling communication. The control processor sends the necessary configuration information to allow the I/O data transfer.
Go Off-line	Disconnects the I/O module from the I/A Series control processor, thus disabling communication. This causes the ISCM to invoke the fail-safe condition (hold or fallback) for the I/O module. The attached I/O points all go out of service (OOS).
Download...	Restarts the I/O module logic. This causes the ISCM to invoke the fail-safe condition (hold or fallback) for the I/O module. The attached I/O points all go out of service (OOS) and then on-line again. This action does **not** download the I/O module image.
EEPROM Update	Not required for I/O modules. If accidentally invoked, it has the same effect as a DOWNLOAD command.
Inhibit PIO Bus Cable A Alarms Inhibit PIO Bus Cable B Alarms	This inhibits alarms for the respective PIO bus A or B.
Enable Communications	For HART I/O cards, this enables digital communication to a HART device. This also puts all of the device I/O points in service.
Disable Communications	For HART I/O cards, this disables digital communication to a HART device. This causes the ISCM to invoke the fail-safe condition (hold or fallback) for the I/O points for this device and will cause all of them to go out of service (OOS).
Enable Device Alarming	For HART I/O cards, enables System Management to indicate a device (system) alarm should this condition exist.
Disable Device Alarming	For HART I/O cards, disables System Management from indicating a device (system) alarm.

SMDH Equipment Information Displays for ISCM and P+F I/O Modules

The system and display management packages discussed in the Overview provide detail displays which allow you to access the equipment information.

These displays reflect the system's current operating status and provide a valuable maintenance aid by allowing you to observe the current operating status of the various system elements and intervene in system operations. For information on navigating through the detail displays, refer to the appropriate system manager display manual.

Equipment Information Display for ISCM

The Equipment Information display page (Figure 5-5 through Figure 5-7) for the ISCM contains operational status, hardware and software information. Table 5-5 describes the available text fields in the order that they appear on the display pages, from left column to right column.

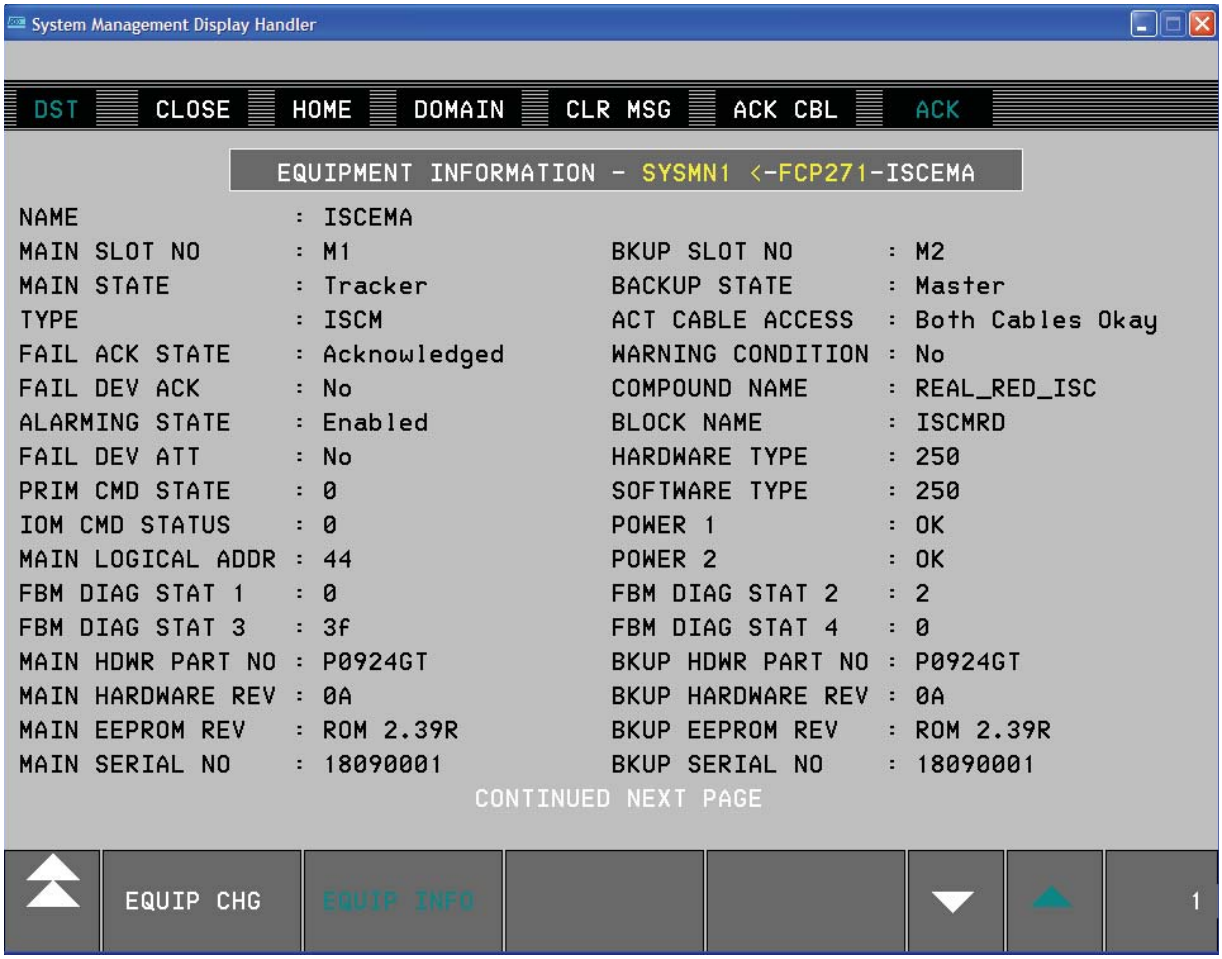


Figure 5-5. Equipment Information Display for ISCM – Page 1 – Typical

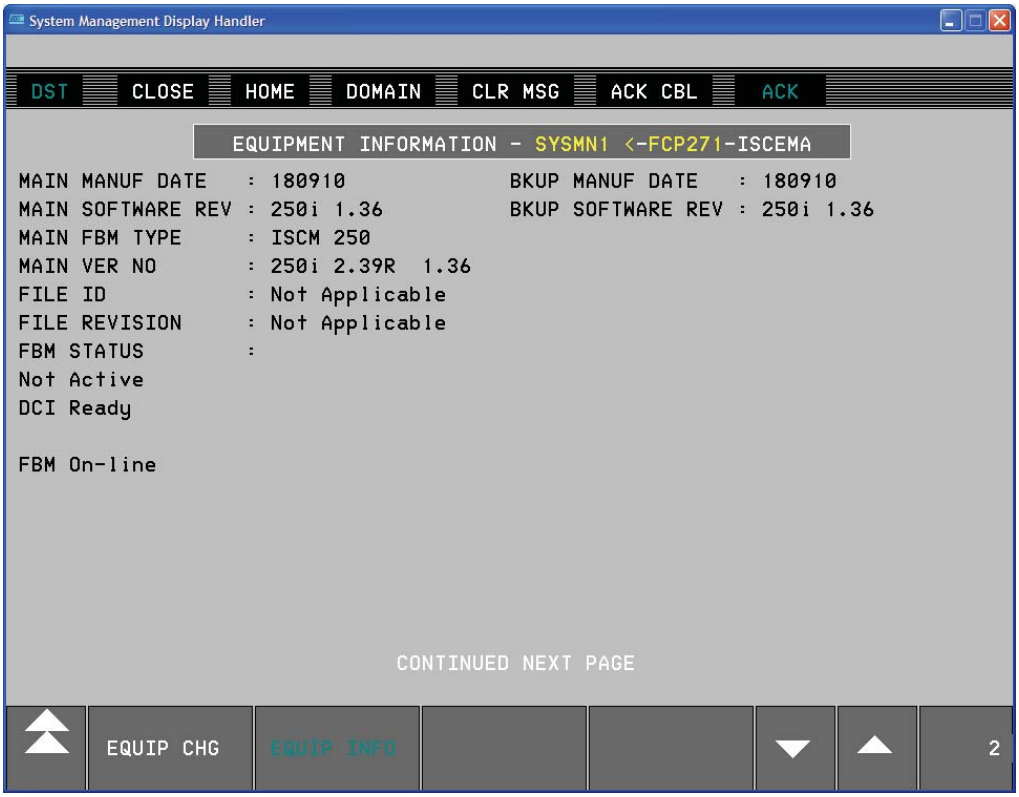


Figure 5-6. Equipment Information Display for ISCM – Page 2 – Typical

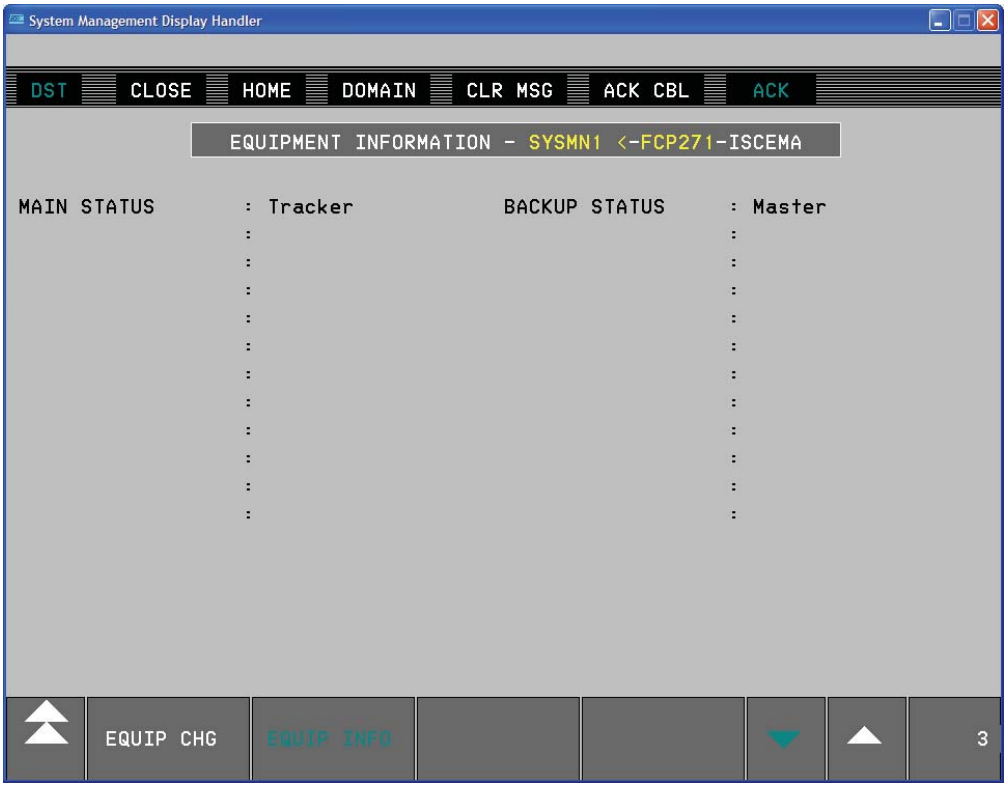


Figure 5-7. Equipment Information Display for ISCM – Page 3 – Typical

Table 5-5. Equipment Information Display Fields for ISCMs

Field	Description
NAME	Module letterbug assigned during definition of system hardware.
MAIN SLOT NO	Unit slot number for the Main ISCM (of a redundant pair)
MAIN STATE	State (Master/Tracker) of the Main ISCM (of a redundant pair)
TYPE	Equivalent 200 Series FBM type for this ISCM (Always "FBM 250").
FAIL ACK STATE	Acknowledged or Not Acknowledged. This field is initially set to Acknowledged. If the DEVICE STATE changes from Not Failed to Failed, the FAIL ACK STATE field changes to Not Acknowledged. Use the ACK key in the top menu bar of the Equipment Information display to acknowledge the selected faulted device; or use the ACK ALL key in the top menu bar of the initial System Management display to acknowledge all the unacknowledged devices for which the workstation has responsibility.
FAIL DEV ACK	Yes (Acknowledged) or No (Not Acknowledged). This field is initialized to Yes. If any of the attached devices become unacknowledged, the field changes to No.
ALARMING STATE	Enabled or Inhibited. This field indicates whether alarming for system alarms, not process alarms, is Enabled or Inhibited for the ISCM. When alarming is Inhibited, the System Monitor continues to indicate overall system and network health (a green "Sys" bar) while equipment is failed or off-line. Additionally, when alarming is inhibited, System Alarm messages are not logged to the system printer, nor the Historian.
FAIL DEV ATT	Yes or No. Yes is displayed if an ISCM is failed; otherwise No is displayed.
PRIM CMD STATE	Primary Command Status is a value related to the status of communication between the I/O module acting as the primary FBM and this ISCM. Typically, this value is 0 or 1, where 1 indicates that a successful retry took place and communication has been restored to normal. Primary Command Status can have the following values: **Value Condition** 0 - Normal, no error 1 - Success with retry (this condition is very rare) 2 - FCM timed out I/O module (ZCP only) 3 - CP timed out FCM (ZCP only) > 3 - Link level protocol error (this is very rare and transient)

Table 5-5. Equipment Information Display Fields for ISCMs (Continued)

Field	Description
IOM CMD STATUS	IOM Command Status is a hexadecimal value associated with the return status included in the header of every response from this ISCM to the I/O module acting as the primary FBM. Typically, the hexadecimal value is 0, indicating the command was understood and action was taken. **Value Condition** 0 - Command understood. 1 - Command not understood. 2 - Command understood, but unable to take action. 4 - Invalid argument.
MAIN LOGICAL ADDR	Logical address for the Main ISCM (of a redundant pair). In an I/A Series system, FBM modules are typically numbered as they appear in the display (left to right) beginning at 21. The FBM order is the order in which the FBMs were installed using the system/control configurator. However, if an FBM is deleted and another added later, the new FBM is given the lowest number available.
FBM DIAG STAT 1	Diagnostic Status 1 is a bit mapped hexadecimal value related to the module power status. See Table 5-7 on page 115 for description of each of the bits.
FBM DIAG STAT 3	Count of non-fatal errors logged by the ISCM. If the module is operating normally, this field can be safely ignored. For resolution of the module hardware and software errors indicated by this diagnostic status field, call the IOM Global Customer Support Center.
MAIN HDWR PART NO	Invensys part number for the Main ISCM (of a redundant pair)
MAIN HARDWARE REV	Hardware revision number of the Main ISCM (of a redundant pair)
MAIN EEPROM REV	EEPROM revision level of the Main ISCM (of a redundant pair)
MAIN SERIAL NO	Last 8 digits of P+F serial number for Main ISCM, blank for I/O modules
MAIN MANUF DATE	First 6 digits of P+F serial number for Main ISCM, blank for I/O modules
BKUP SLOT NO	Unit slot number for the Backup ISCM (of a redundant pair)
BACKUP STATE	State (Master/Tracker) of the Backup ISCM (of a redundant pair)
ACT CABLE ACCESS	Possible values reflect the health of both cables (Both Cables OK, Cable A Not OK, Cable B Not OK, Both Cables Not OK). This field applies to the selected device and indicates whether transmissions were successfully sent the last time either Bus A or B was used.
WARNING CONDITION	Yes or No. If the device has a non-fatal error condition, it is indicated in this field.
COMPOUND NAME/ BLOCK NAME	The control database full pathname of the ECB associated with the ISCM.

Table 5-5. Equipment Information Display Fields for ISCMs (Continued)

Field	Description
HARDWARE TYPE	Number associated with the FBM type for the ISCM. (Always "250".) See the tables in "ISCM Configuration" on page 44.
SOFTWARE TYPE	Indicates the type of application software (ECB) being used with the designated FBM hardware type. (Always "250".) See the tables in "ISCM Configuration" on page 44.
POWER 1	OK or Failed indicates the state of power supplies on the base unit
POWER 2	OK or Failed indicates the state of power supplies on the extension unit
FBM DIAG STAT 2	Diagnostic Status 2 is a hexadecimal value indicating the ISCM startup condition. Hexadecimal values and the related conditions are as follows: **Value Condition** 1 - Power Fail Recovery (Power up) 2 - Download Recovery (Reset) 4 - Watchdog timer failure (ISCM only) 8 - Warm Reset (Off Line / On Line) If the module is operating normally, this field can be safely ignored.
FBM DIAG STAT 4	Diagnostic Status 4 is a hexadecimal value relating to the current software or hardware error for the selected module. Normally, this value is 0 (no error). Other values are fatal errors; the module is not operational. Typical values and their meaning are as follows: **Value Condition** 0 - No error 15 - Hardware type mismatch (module installed in the wrong slot) 16 - Software type mismatch (ECB configuration error) ff - EEPROM update in progress (non-fatal indication) Corrective actions include: ♦ Installing the module in the correct slot ♦ Correcting ECB configuration errors ♦ Restarting the module using the DOWNLOAD function on the Equipment Change display ♦ Reloading the module software using the EEPROM UPDATE function. (ISCM only) If the above actions do not correct the problem, call the IOM Global Client Support Center.
BKUP HDWR PART NO	Invensys part number for the Backup ISCM (of a redundant pair)
BKUP HARDWARE REV	Hardware revision number of the Backup ISCM (of a redundant pair)
BKUP EEPROM REV	EEPROM revision level of the Backup ISCM (of a redundant pair)
BKUP SERIAL NO	Last 8 digits of P+F serial number for Backup ISCM, blank for I/O modules

Table 5-5. Equipment Information Display Fields for ISCMs (Continued)

Field	Description
BKUP MANUF DATE	First 6 digits of P+F serial number for Backup ISCM, blank for I/O modules

Equipment Information Display for P+F I/O Modules

The Equipment Information display pages (Figure 5-8 and Figure 5-9) for the P+F I/O modules contain operational status, equipment change action status, hardware and software information. Table 5-6 describes the available text fields in the order that they appear on the display pages, from left column to right column.

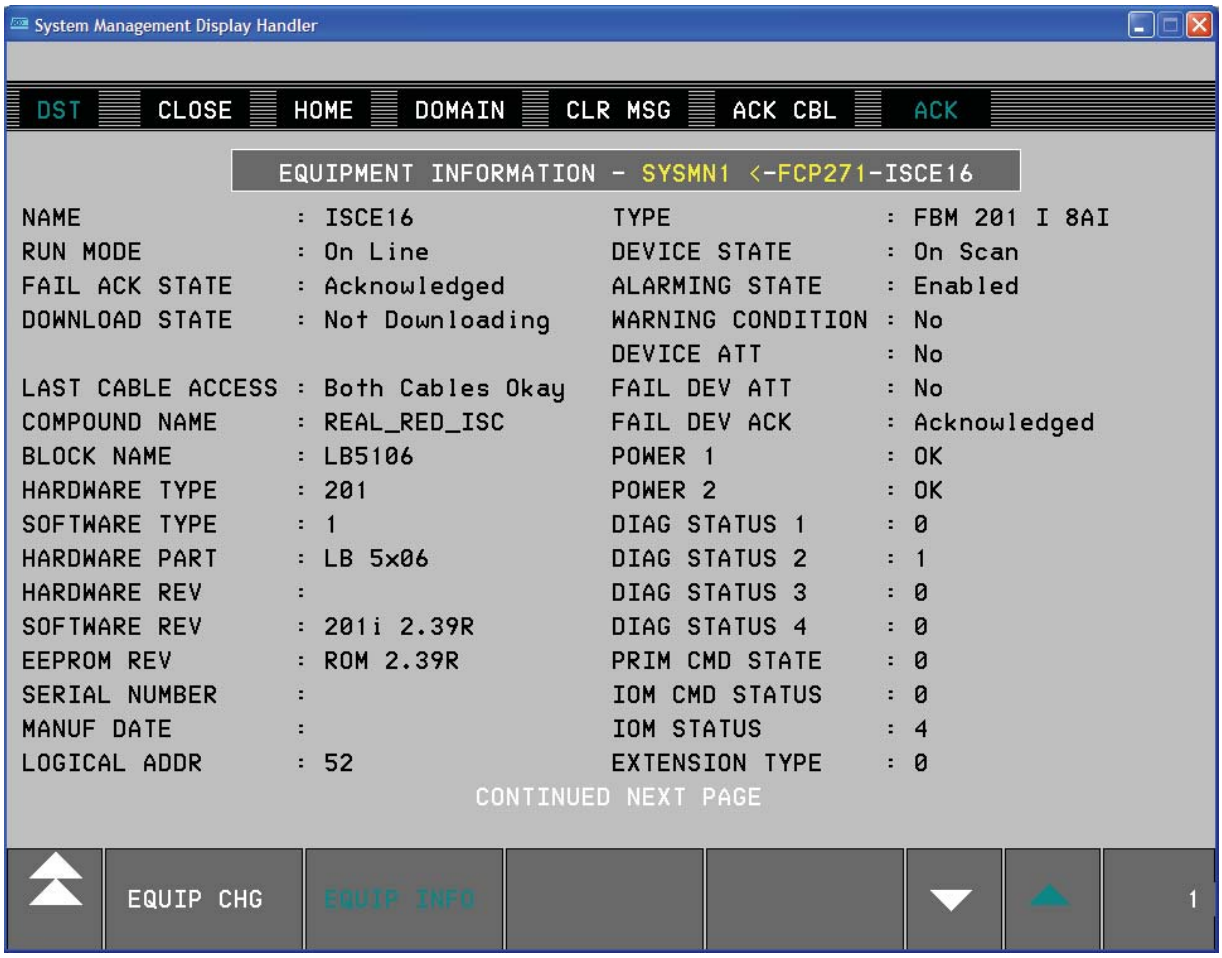


Figure 5-8. Equipment Information Display for P+F I/O Modules – Page 1 – Typical

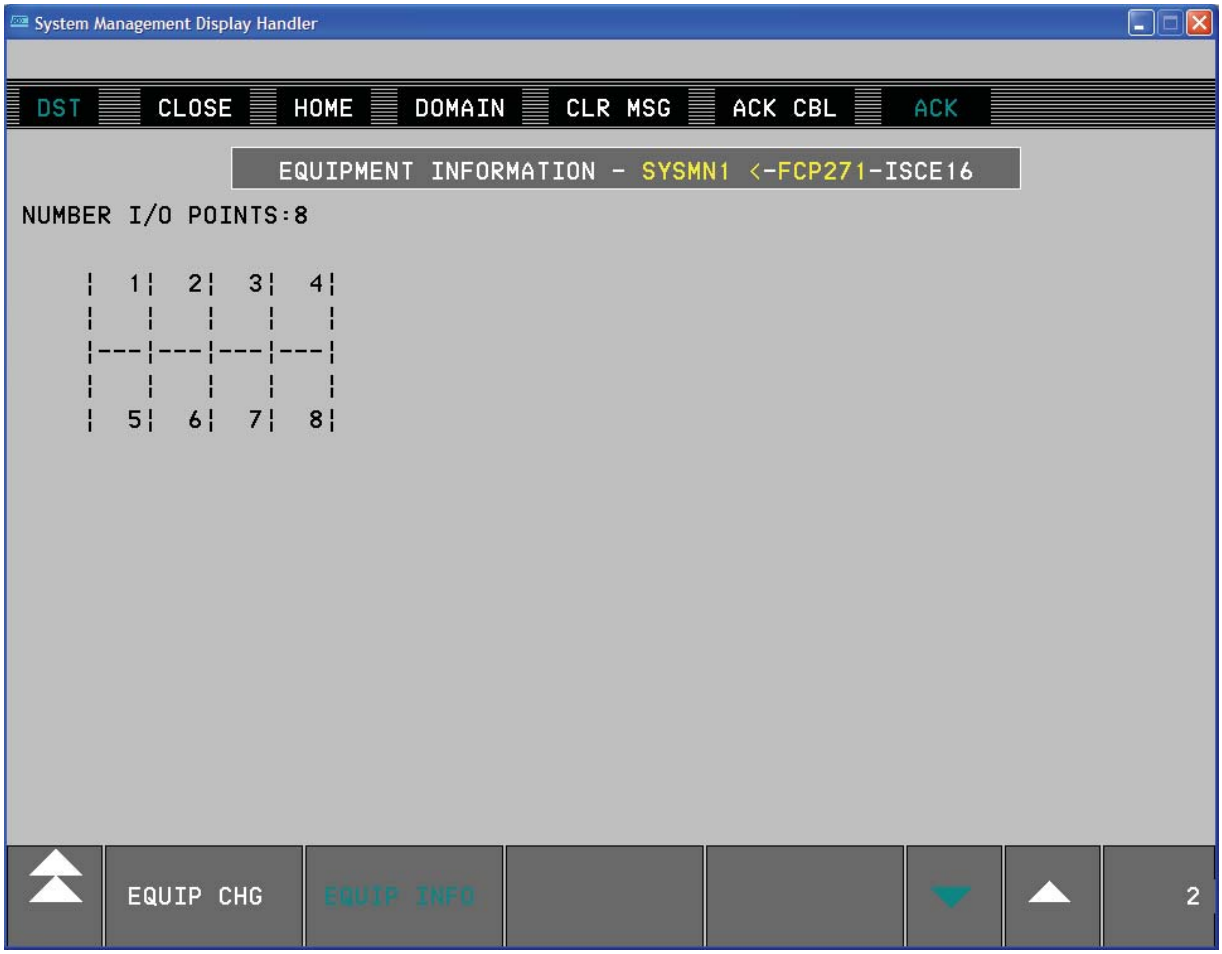


Figure 5-9. Equipment Information Display for P+F I/O Modules – Page 2 – Typical

Table 5-6. Equipment Information Display Fields for P+F I/O Modules

Field	Description
NAME	Module letterbug assigned during definition of system hardware. The name for the I/O modules can be added “on-the-fly”; they are not strictly required to be configured during the system configuration and committal.
RUN MODE	On-line or Off-line (default) is displayed. (All ECBs are off-line by default once configured, and then must be turned on-line.) Set the RUN MODE using the GO ON-LINE and GO OFF-LINE options in the Equipment Change Display. If the I/O module automatically goes off-line: ♦ Check hardware ♦ Check related fields ♦ Download (restart) the I/O module.

Table 5-6. Equipment Information Display Fields for P+F I/O Modules (Continued)

Field	Description
FAIL ACK STATE	Acknowledged or Not Acknowledged. This field is initially set to Acknowledged. If the DEVICE STATE changes from Not Failed to Failed, the FAIL ACK STATE field changes to Not Acknowledged. Use the ACK key in the top menu bar of the Equipment Information display to acknowledge the selected faulted device; or use the ACK ALL key in the top menu bar of the initial System Management display to acknowledge all the unacknowledged devices for which the workstation has responsibility.
DOWNLOAD STATE	Downloading or Not Downloading. This field is initially set to Not Downloading. When the module is rebooted via an operator-initiated request, the status changes to Downloading until the action is completed.
LAST CABLE ACCESS	Possible values reflect the health of both cables (Both Cables OK, Cable A Not OK, Cable B Not OK, Both Cables Not OK). This field defines the state of the HDLC fieldbus which connects to the ISCM to which the selected P+F I/O module connects. This field indicates whether transmissions were successfully sent the last time either Bus A or B was used.
COMPOUND NAME/ BLOCK NAME	The control database full pathname of the ECB associated with the I/O module.
HARDWARE TYPE	Number associated with the FBM type for the I/O module. See the tables in “Intrinsically Safe I/O Module Configuration” on page 57.
SOFTWARE TYPE	Indicates the type of application software (ECB) being used with the designated FBM hardware type. See the tables in “Intrinsically Safe I/O Module Configuration” on page 57.
HARDWARE PART	P+F Model number in the form of “LB 1x01” for LB 1101 or “FB 1x01” for FB 1201, for example. (The second digit in the model number is always replaced with “x”.)
HARDWARE REV	Blank for P+F I/O modules.
SOFTWARE REV	Module’s software revision number.
EEPROM REV	EEPROM revision level.
SERIAL NUMBER	Blank for P+F I/O modules.
MANUF DATE	Manufacturing date code of the ISCM, blank for P+F I/O modules.
LOGICAL ADDR	In an I/A Series system, FBM modules are typically numbered as they appear in the display (left to right) beginning at 21. The FBM order is the order in which the FBMs were installed using the system/control configurator. However, if an FBM is deleted and another added later, the new FBM is given the lowest number available.
TYPE	Equivalent 200 Series FBM type for this P+F I/O module, and the number/type of inputs/outputs. In this example, 8AI indicates eight analog inputs for a standard FBM201 type. The type is defined when the ECB is assigned during the site planning and system definition phases. Note that P+F I/O modules have fewer I/O channels than the number indicated here.

Table 5-6. Equipment Information Display Fields for P+F I/O Modules (Continued)

<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>DEVICE STATE</td><td>Possible mutually exclusive states are:.

<table>
<tr><th>STATE</th><th>Description</th></tr>
<tr><td>On Scan</td><td>The module is connected to the control strategy, though measurements are not guaranteed to be good.</td></tr>
<tr><td>Comm Failures</td><td>No real module information is available.</td></tr>
<tr><td>Failed</td><td>Fatal hardware or other fatal fault reported by the module. This presupposes that communication has not failed.</td></tr>
<tr><td>Not Ready</td><td>Transition state. The module is healthy, and normal automatic startup procedures are bringing the device On Scan.</td></tr>
</table></td></tr>
<tr><td>ALARMING STATE</td><td>Enabled or Inhibited. This field indicates whether alarming for system alarms, not process alarms, is Enabled or Inhibited for the I/O module. When alarming is Inhibited, the System Monitor continues to indicate overall system and network health (a green “Sys” bar) while equipment is failed or off-line. Additionally, when alarming is inhibited, System Alarm messages are not logged to the system printer, nor the Historian.</td></tr>
<tr><td>WARNING CONDITION</td><td>Yes or No. If the device has a non-fatal error condition, it is indicated in this field.</td></tr>
<tr><td>DEVICE ATT (HART modules only)</td><td>Yes or No. Yes is displayed if a HART I/O module has devices attached; otherwise No is displayed.</td></tr>
<tr><td>FAIL DEV ATT (HART modules only)</td><td>Yes or No. Yes is displayed if a HART I/O module device is failed; otherwise No is displayed.</td></tr>
<tr><td>FAIL DEV ACK</td><td>Acknowledged or Not Acknowledged. This field is initialized to Acknowledged. If any of the attached devices become unacknowledged, the field changes to Not Acknowledged.</td></tr>
<tr><td>POWER 1</td><td>OK or Failed indicates the state of power supplies on the base unit.</td></tr>
<tr><td>POWER 2</td><td>OK or Failed indicates the state of power supplies on the extension unit</td></tr>
<tr><td>DIAG STATUS 1</td><td>Diagnostic Status 1 is a bit mapped hexadecimal value related to the module power status. See Table 5-7 on page 115 for description of each of the bits.</td></tr>
</table>

Table 5-6. Equipment Information Display Fields for P+F I/O Modules (Continued)

Field	Description
DIAG STATUS 2	Diagnostic Status 2 is a hexadecimal value indicating the module startup condition. Hexadecimal values and the related conditions are as follows: **Value Condition** 1 - Power Fail Recovery (Power up) 2 - Download Recovery (Reset) 4 - Watchdog timer failure (ISCM only) 8 - Warm Reset (Off Line / On Line) If the module is operating normally, this field can be safely ignored.
DIAG STATUS 3	0 for P+F I/O modules. If the module is operating normally, this field can be safely ignored. For resolution of the module hardware and software errors indicated by this diagnostic status field, call the IOM Global Customer Support Center.
DIAG STATUS 4	Diagnostic Status 4 is a hexadecimal value relating to the current software or hardware error for the selected module. Normally, this value is 0 (no error). Other values are fatal errors; the module is not operational. Typical values and their meaning are as follows: **Value Condition** 0 - No error 15 - Hardware type mismatch (module installed in the wrong slot) 16 - Software type mismatch (ECB configuration error) ff - EEPROM update in progress (non-fatal indication) Corrective actions include: ♦ Installing the module in the correct slot ♦ Correcting ECB configuration errors ♦ Restarting the module using the DOWNLOAD function on the Equipment Change display ♦ Reloading the module software using the EEPROM UPDATE function. (ISCM only) If the above actions do not correct the problem, call the IOM Global Customer Support Center.

Table 5-6. Equipment Information Display Fields for P+F I/O Modules (Continued)

Field	Description
PRIM CMD STATE	Primary Command Status is a value related to the status of communication between the I/O module acting as the primary FBM and this I/O module. Typically, this value is 0 or 1, where 1 indicates that a successful retry took place and communication has been restored to normal. Primary Command Status can have the following values: **Value Condition** 0 - Normal, no error 1 - Success with retry (this condition is very rare) 2 - FCM timed out I/O module (ZCP only) 3 - CP timed out FCM (ZCP only) > 3 - Link level protocol error (this is very rare and transient)
IOM CMD STATUS	IOM Command Status is a hexadecimal value associated with the return status included in the header of every response from this I/O module to the I/O module acting as the primary FBM. Typically, the hexadecimal value is 0, indicating the command was understood and action was taken. **Value Condition** 0 - Command understood. 1 - Command not understood. 2 - Command understood, but unable to take action. 4 - Invalid argument.
IOM STATUS	IOM Status is a hexadecimal value related to the current I/O module status. Typically this value is 4, indicating the module is on-line. **Value Condition** 1 - Module status has changed – requests CP to poll for extended status. 2 - Diagnostic Register is nonzero. This indicates a fatal error. The module does not start if this value is set. 4 - Non-fail-safe condition. This is the typical status for a module that is on-line. This value is reset only if the outputs of the module are in fail-safe. 40 - Module is off-line. In off-line mode, the I/O is unavailable for control. 80 - Initialization is taking place – all channel and I/O data is initializing. Also, indicates that the module has a delayed response message ready.
EXTENSION TYPE	Not applicable to P+F I/O modules. (Always 0)

Also, see “Line Fault Detection and Bad I/O Alarming” on page 25 for more information on the displays for the LB 1108 A module.

Power Supply Status Bits for the ISCM and P+F I/O Modules

Table 5-7 provides the descriptions for the power supply status bits displayed in the DIAG STATUS 1 field for the ISCM and the P+F I/O modules.

Table 5-7. Power Supply Status Bits for the ISCM and I/O Modules

Bit	Zone 2 I/O Modules (LB-Style)	Zone 1 I/O Modules (FB-Style)
0 (LSB)	One or two power supplies on base unit failed	Power supply on base or redundancy unit failed
1	One or two power supplies on extension unit failed	One power supply on extension unit failed
2	Power supply 1 (left) on base unit failed	Power supply on base unit failed
3	Power supply 2 (middle) on base unit failed	Power supply on redundancy unit failed
4	Power supply 3 (right) on base unit failed	Always 0
5	Power supply 1 (left) on extension unit failed	Power supply 1 (upper) on extension unit failed
6	Power supply 2 (middle) on extension unit failed	Power supply 2 (lower) on extension unit failed
7 (MSB)	Power supply 3 (right) on extension unit failed	Always 0

You can determine these bit settings from the following example. If the value of the DIAG STATUS field is “44”, it is “68” when converted from hexadecimal to decimal. The bit breakdown for “68” would be as follows:

Bits	7	6	5	4	3	2	1	0
Bit Values	0	1	0	0	0	1	0	0
Decimal Value		64				4		

This indicates that bits 6 and 2 are set.

SMDH Equipment Change Displays for ISCM and P+F I/O Modules

The system and display management packages discussed in the Overview provide ISCM change displays which allow you to access:

- Equipment information displays
- Configuration information displays
- Equipment change action displays

These displays reflect the system's current operating status and provide a valuable maintenance aid by allowing you to observe the current operating status of the various system elements and intervene in system operations.

For information on navigating through the ISCM detail displays in FoxView, refer to "ECB200, ECB202 – Parent ECBs for DCI Based FBM Types" in *Process Operations and Displays* (B0700BN).

For information on navigating through the ISCM detail displays in SMDH, refer to "Equipment Information for Fieldbus Communications Modules (FCMs)" in *System Management Displays* (B0193JC).

For information on navigating through the ISCM detail displays in the System Manager, refer to the chapter "FCMs" in *System Manager* (B0750AP).

For information on viewing the ISCM runtime information in the InFusion View application, refer to *InFusion View User's Guide, Control Edition* (B0750AQ).

Equipment Change Display for ISCM

The Equipment Change display for the ISCM is shown in Figure 5-10. The actions that are active for this display are described in Table 5-8.

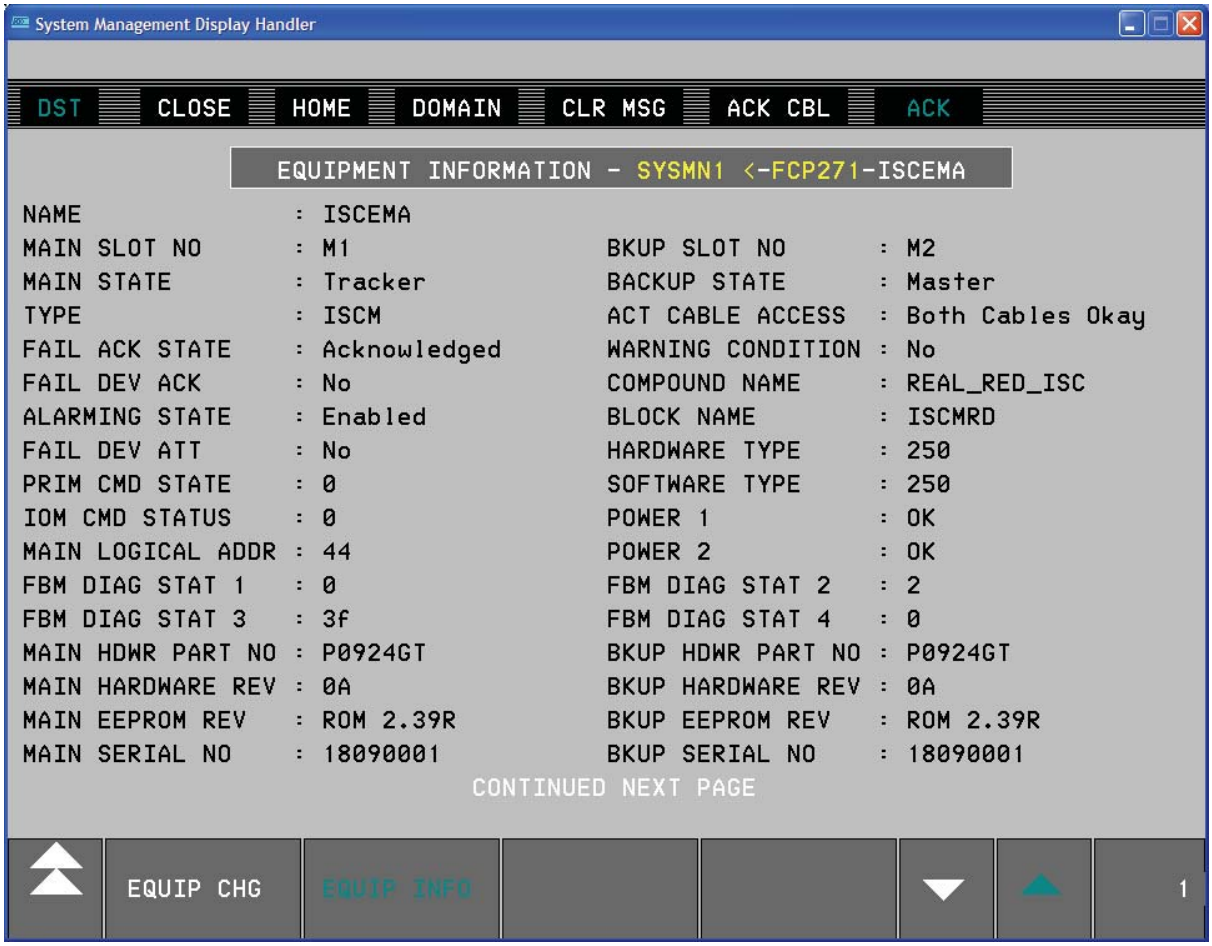


Figure 5-10. SMDH Equipment Change Display for ISCMs

⚠ CAUTION

Only designated personnel who are aware of the effects of making equipment changes should initiate equipment changes.

Table 5-8. Equipment Change Display Fields for ISCM

Field	Description
GO ON-LINE	Puts the ISCM on-line and readies it to communicate with the P+F I/O modules that are attached.
GO OFF-LINE	Puts the ISCM off-line. This terminates all communications for the attached I/O modules and causes them to invoke their fail safe conditions (hold or fallback). The attached I/O cards all show a communications failure when the ISCM is off-line. See the NOTE below.

Table 5-8. Equipment Change Display Fields for ISCM (Continued)

Field	Description
DOWNLOAD	Reboots the ISCM by resetting the hardware. This causes a complete reinitialization of the data structures of the ISCM and the I/O modules. The I/O modules invoke their fail-safe conditions (hold or fallback). The attached I/O modules all show a communications failure until the ISCM is back on-line and the communications have been reestablished with each I/O module. See the NOTE below.
EEPROM UPDATE	Puts the ISCM off-line and downloads a new image to the flash ROM to be burned. Once the burn is complete, the ISCM's new software is downloaded to begin execution of the new image. During this operation, all communications with the attached I/O modules is terminated and fail-safe conditions (hold or fallback) are invoked. See the NOTE below.
ENABLE DEVICE ALARMING	Allows ISCM device (system) alarms to propagate upward in the I/A Series system.
INHIBIT DEVICE ALARMING	Inhibits ISCM device (system) alarms from propagating upward in the I/A Series system.
SWITCH ROLES (redundant ISCMs only)	Allows the ISCMs exchange mastership.

NOTE

"**Go Off-Line...**", "**Reset FBM...**" and "**EEPROM Update...**" of an ISCM that is redundant and has its partner on-line will maintain all communication with the I/O modules during these operations. For this reason, do not perform this operation on both ISCMs at the same time. Wait until the operation has completed on one ISCM and it comes back on-line before performing the operation on the other module. It is also recommended that you do not perform the operation on the Master ISCM without first using the "Switch Roles" command to first make it the Tracker. Performing these operations on the Master ISCM could result in a temporary loss of communication with one or more of the I/O modules.
Refer to "EEPROM Update Procedure for Redundant ISCMs" on page 101 for the EEPROM update procedure.

Equipment Change Display for P+F I/O Modules

The Equipment Change display for the P+F I/O modules is shown in Figure 5-11. The actions that are active for this display are described in Table 5-9.

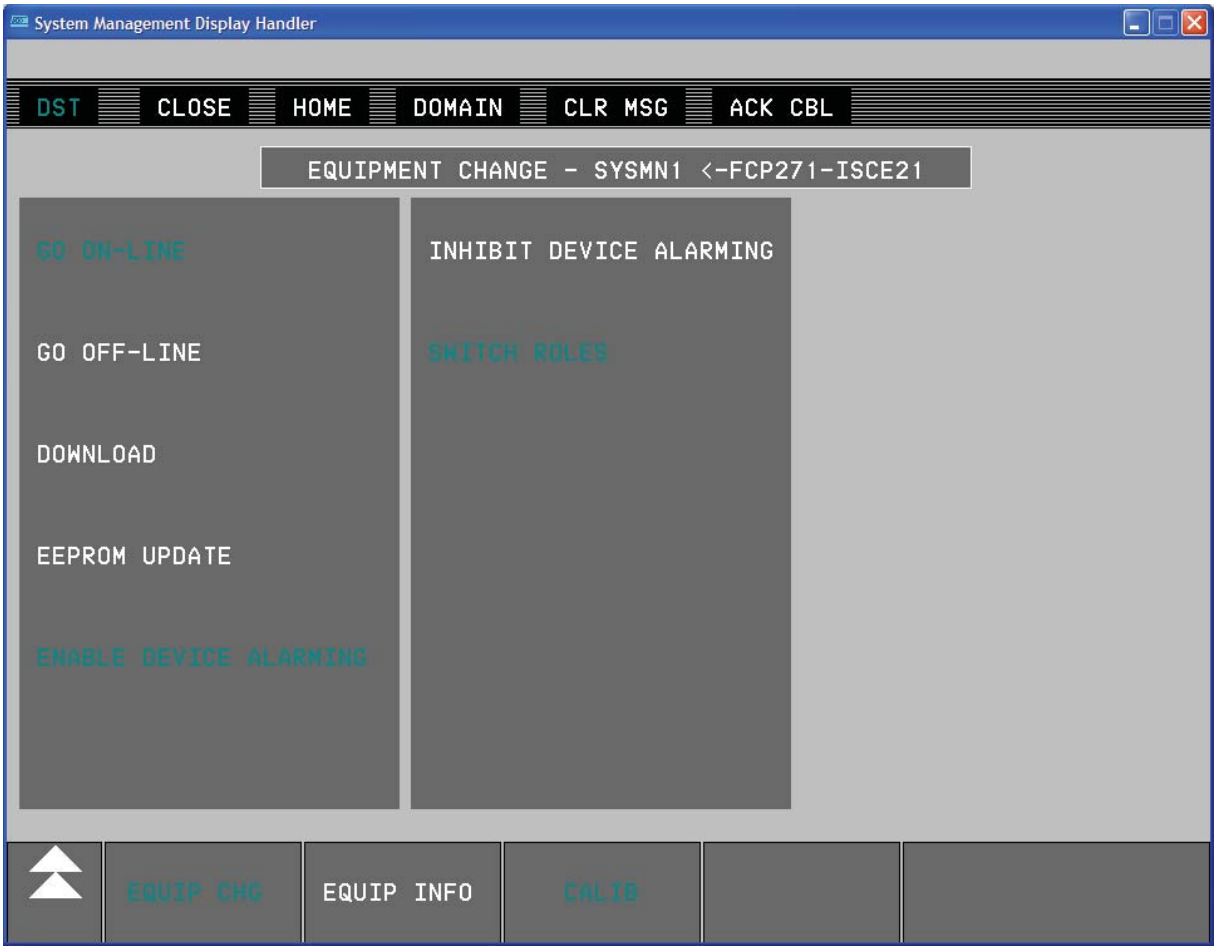


Figure 5-11. Equipment Change Display for P+F Modules

⚠ CAUTION

Only designated personnel who are aware of the effects of making equipment changes should initiate equipment changes.

Table 5-9. Equipment Change Display Fields for P+F I/O Modules

Field	Description
GO ON-LINE	Connects the I/O module to the I/A Series control processor, thus enabling communication. The control processor sends the necessary configuration information to allow the I/O data transfer.

Table 5-9. Equipment Change Display Fields for P+F I/O Modules

Field	Description
GO OFF-LINE	Disconnects the I/O module from the I/A Series control processor, thus disabling communication. This causes the ISCM to invoke the fail-safe condition (hold or fallback) for the I/O module. The attached I/O points all go out of service (OOS).
DOWNLOAD	Restarts the I/O module logic. This causes the ISCM to invoke the fail-safe condition (hold or fallback) for the I/O module. The attached I/O points all go out of service (OOS) and then on-line again. This action does **not** download the I/O module image.
EEPROM UPDATE	Not required for I/O modules. If accidentally invoked, it has the same effect as a DOWNLOAD command.
ENABLE DEVICE ALARMING	Allows device (system) alarms to propagate upward in the I/A Series system to the FCP/ZCP.
INHIBIT DEVICE ALARMING	Inhibits device (system) alarms from propagating upward in the I/A Series system to the FCP/ZCP.
NEXT LEVEL (SMDH only)	For HART I/O cards, this shows the device level display and their respective commands described below.
ENABLE COMMUNI-CATIONS	For HART I/O cards, this enables digital communication to a HART device. This also puts all of the device I/O points in service.
DISABLE COMMU-NICATIONS	For HART I/O cards, this disables digital communication to a HART device. This causes the ISCM to invoke the fail-safe condition (hold or fallback) for the I/O points for this device and will cause all of them to go out of service (OOS).
ENABLE DEVICE ALARMING	For HART I/O cards, enables System Management to indicate a device (system) alarm should this condition exist.
DISABLE DEVICE ALARMING	For HART I/O cards, disables System Management from indicating a device (system) alarm.
Inhibit PIO bus A and/or B cable alarms	This inhibits alarms for the respective PIO bus A or B.

— NOTE

For more information and procedures for performing equipment change actions, refer to *System Management Displays* (B0193JC).

6. Troubleshooting

This chapter describes possible ISCM failure situations and provides diagnostic routines that allow you to locate and resolve unit failures quickly.

Overview

Maintenance of the ISCM and IS I/O modules is required when the following events occur:

- The ISCM or an I/O module shows a failed state in System Management
- An I/O point shows a BAD state at the block level that is not caused by an input signal that is broken or in error.

In most cases, problems occur because the ISCM or its associated I/O modules is misconfigured or there are faulty network connections. In the event of a true hardware failure, the maintenance approach is oriented toward module replacement.

Failed ISCMs may be replaced (hot swapped) while the rest of the system is operational without the need for power cycling the rest of the system. The replaced ISCM(s) self-configure and come on-line in exactly the same manner as the I/A Series 200 Series FBMs operate. Note that a failure in a non-redundant ISCM usually results in all of the attached I/O modules being failed as well.

The ECB200 and ECB202 displays provide information to help you evaluate ISCM performance. For more information, refer to *Integrated Control Block Descriptions* (B0193AX), *Process Operations and Displays* (B0700BN) and *System Manager* (B0750AP).

External maintenance operations are performed through SMDH or System Manager and allow the following functions for the ISCM:

- Turn the I/O module off-line - all I/O points go out of service, outputs go to fail-safe.
- Turn the I/O module on-line - all I/O points go in service.
- Download (reboot) the I/O module - all I/O points go out of service, outputs go to fail-safe, and come back in service.
- EEPROM Update the I/O module - all I/O points go out of service, outputs go to fail-safe, and come back in service (Same effect as download - the ISCM will not send any EEPROM updates to the I/O modules).
- Disable Communications (HART device only) - all I/O points go out of service, outputs go to fail-safe.
- Enable Communications (HART device only) - all I/O points go in service.
- Disable Device Alarming - disables alarming at the System Management level. No effect on the I/O block alarming.
- Enable Device Alarming - enables alarming at the System Management level. No effect on the I/O block alarming.
- Turn the ISCM off-line - The ISCM and all I/O points go out of service, outputs go to fail-safe. I/O cards are shown with a communication failure.
- Turn the ISCM on-line - The ISCM and I/O points return to service.

- EEPROM Update the non-redundant ISCM - The ISCM and all I/O points go out of service and all outputs go to fail-safe. I/O cards are shown with a communication failure. The EEPROM is updated in the ISCM with a new image, the ISCM is rebooted and all come back on-line. See the note on page 100.
- EEPROM Update one ISCM of a redundant pair - The ISCM goes off-line and the EEPROM in the ISCM is updated with a new image. The ISCM is rebooted and will come back on-line. The I/O is maintained as long as the redundant partner remains on-line during the EEPROM update. See the note on page 100.

Failed modules and base/extension units are to be handled through the normal P+F module exchange and repair programs. It is recommended that sufficient spares be stocked at the customer location so that any module failures may be immediately addressed to minimize any potential down time.

Failure modes and effects for the ISCM and the I/O modules are the same as for the I/A Series 200 Series FBMs. These include input and output data status indications and output fail-safe configuration.

ISCM LED Indicators

Light-emitting diodes (LEDs) on the front of the ISCM (Figure 6-1) provide visual indication of the module's operational status.

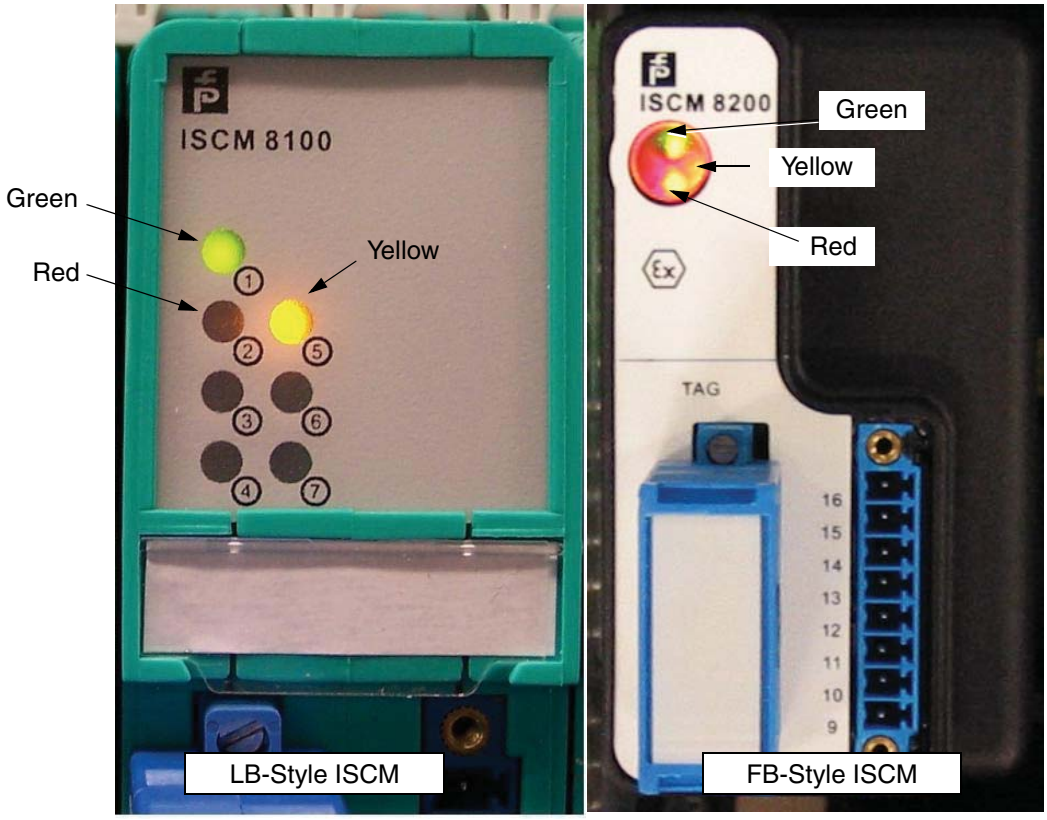


Figure 6-1. LB-Style and FB-Style ISCM LED Indicators

ISCM Operational Status LED Indicators

The Operational Status LEDs (red, yellow and green) on the front of the ISCM indicate the module's operational status. Table 6-1 describes the operational conditions indicated by these LEDs.

Table 6-1. ISCM Operational Status LEDs

Red LED	Green LED	Yellow LED	Status
OFF	OFF	OFF	No power to the ISCM base/extension unit
Flashing	OFF	OFF	Power up self test in progress
OFF	Rapid Flashing	OFF/ Flashing	ISCM is rebooting. Yellow OFF in Main ISCM, Flashing in Backup ISCM
Flashing	ON	OFF/ Flashing	ISCM awaiting initialization from the CP. Yellow OFF in Tracker, flashing in Master.
OFF	ON	Flashing	ISCM is running and controlling I/O, no module fault
ON	ON	Flashing	ISCM is running and controlling I/O; One or more modules have an I/O fault
OFF	ON	OFF	ISCM is running as Tracker of a redundant pair

ISCM Troubleshooting

The following troubleshooting information is intended as a service guide for some of the most commonly encountered system problems. Problems that surface in many cases are faults associated with communication paths (cables, connectors, internal data and power buses, and so forth). At the module (ISCM) level, the quickest way to determine and correct the problem is by replacement. When spare parts are not available, the following checks may provide a practical approach.

⚠ CAUTION

1. Do not attempt to repair modules in the field!
2. To reboot the ISCM, use System Management or System Manager displays if possible.

NOTE

The full 14 digit P+F serial number of the ISCM can be obtained from System Manager or SMDH displays in addition to the label on the side of the ISCM. The first six digits are shown in the "Manufacture Date" field and the last eight digits are shown in the "Serial Number" field. For example, if the "Manufacture Date" field is "900619" and the "Serial number" field is "57295693", the full serial number is "90061957295693".

The serial numbers for the I/O modules are not available in the System Manager or SMDH displays. These numbers must be read from the label on the side of the I/O modules.

Using the ISCM Operational Status LEDs

The Operational Status LEDs (red, green and yellow) on the front of the ISCM (see Figure 6-1) indicate the module's operational status.

Red off, Green off, Yellow Off

When all LEDs are off, this typically indicates loss of dc power. Perform the following checks. (These checks need not be followed in order.)

1. If other module(s) in the modular base/extension unit are operating correctly, then:
   - Cycle power to the failed ISCM off then on by pulling the module from the base/extension unit and pushing the module back on the unit.
   - Replace the failed ISCM with a known good module to test that slot in the unit (see "Replacing a Failed ISCM or I/O Module" on page 127).
   - Remove the ISCM and check the connector for bent pins. For module removal procedures, see "Replacing a Failed ISCM or I/O Module" on page 127).
2. Use a multimeter to verify that the dc voltage at the input terminals of the base/extension unit is within the range of 21.6 to 25.2 V dc.
3. Verify that the power cable is firmly connected to the unit and 24 V dc power supply.
4. If all modules on the base/extension unit have failed and the power supply is operating normally, disconnect the power cable from the power supply and base/extension unit, and use a multimeter to verify continuity of the cable conductors, or replace the cable.

If none of the above checks resolve the failure, you must replace the ISCM module.

Red flashing, Others off

When the red LED is on and the other LEDs are off, this indicates that the module was unable to pass the startup diagnostics. This usually indicates a hardware fault of some kind. Hardware faults are typically internal to the ISCM, but you can try the following tests to correct the problem:

1. Reboot the ISCM using the System Management displays using the DOWNLOAD or RESET FBM function from SMDH or the System Manager.
2. Cycle power to the ISCM off then on by pulling the module from the modular base/extension unit and pushing the module back on the unit.
3. Ensure that the letterbug switch in the ISCM is set to the correct position as defined in the Control Processor configuration. If a redundant pair of ISCMs are installed, both letterbug switches **must** be set to the same position as well.
4. If the module is part of a redundant pair, replace it and verify that the new module comes on-line successfully.
5. Check for insufficient voltage, as shown in Steps 1 through 3 in the previous section.

Green on, Red flashing, Yellow off or flashing

After power-up self tests, this is the default condition of the LEDs. Once the ISCM is running, software turns off the red LED unless there is a fault in an attached I/O module. If this state persists, a processor or communication fault probably exists. Please be patient with this state - if the CP is downloading the ISCM and I/O module configuration, it may stay in this state for as long

as two minutes. Yellow is off in the Tracker ISCM, and flashing in a non-redundant or Master ISCM of a redundant pair.

If this state continues, check the following items

1. Check the HDLC cabling between the ISCM base/extension unit and the CP.
2. Verify that the FBM0 of the CP is on-line and not failed in System Management.

Verify that the ISCM is on-line and not failed in System Management. If the ISCM shows that it is failed and the other items are OK, then you must replace the ISCM.

Green on, Red off, Yellow flashing

When the green LED is on, the red LED is off and the yellow LED is flashing, this indicates that the module is on-line and functional. This is the normal operating state for a non-redundant ISCM or the Master ISCM of a redundant pair.

Green on, Red and Yellow off

When the green LED is on and the red and yellow LEDs are off, this indicates that the Tracker ISCM module of a redundant pair is on-line and functional. This is the normal operating state for the Tracker ISCM of a redundant pair.

Green on, Red on, and Yellow flashing

When the green and red LEDs are on and the yellow LED is flashing, and this ISCM is non-redundant or the Master ISCM of a redundant pair, one or more I/O modules have a fault.

P+F I/O Module LED Indicators

Light-emitting diodes (LEDs) on the front of the I/O modules (Figure 6-2) provide visual indication of the modules' operational status and channel state for some I/O modules.

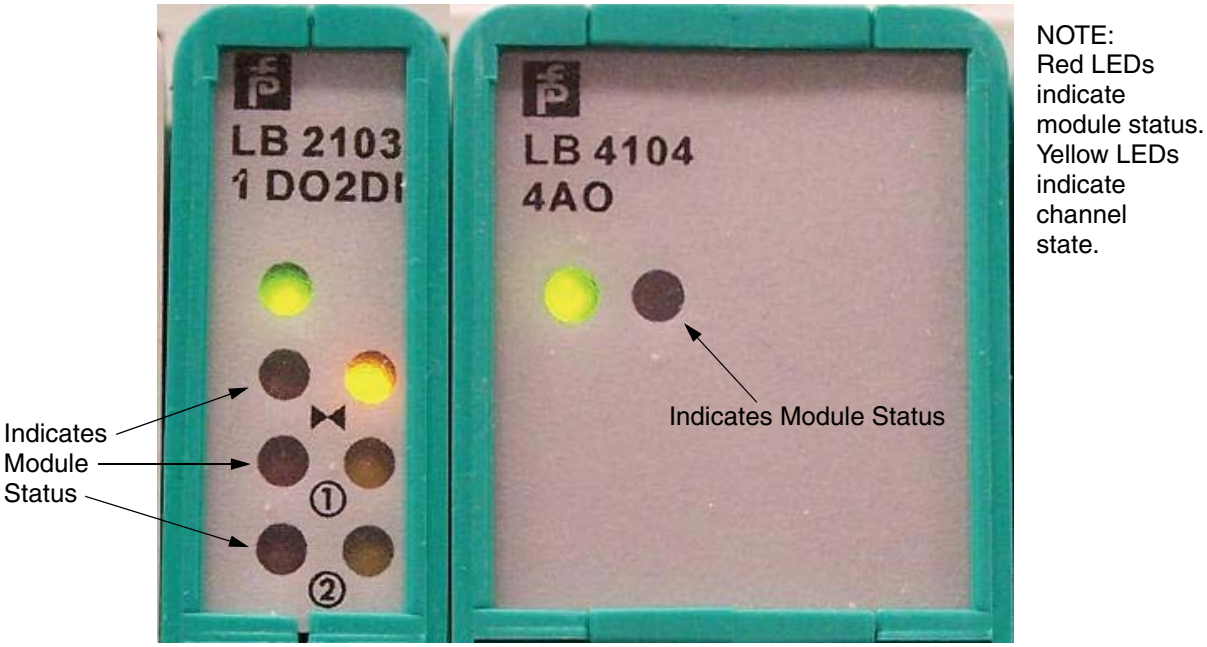


Figure 6-2. P+F I/O Module LED Indicators

— NOTE

The yellow LEDs in the right column of the LB 2103 module shown in Figure 6-2 are channel state indicators (on or off). These indicators are present on only the LB 2101-2113 and the LB 6101 modules only. The LB 3102 module also has one yellow LED that indicates that the input is below 4 mA. All other modules have only one red and one green LED.

I/O Module Operational Status LED Indicators

The Operational Status LEDs (red and green) on the front of the I/O modules indicate the modules' operational status. Table 6-2 describes the operational conditions indicated by these LEDs.

Table 6-2. P+F I/O Module Operational Status LEDs

Green LED	Red LED	Status
OFF	OFF	No power to the I/O module or to the base/extension unit
ON	Flashing	Module is not communicating with the ISCM
ON	OFF	Module is operating properly without fault
ON	ON	Module has detected a fatal fault or open or shorted line fault

P+F I/O Module Troubleshooting

The following troubleshooting information is intended as a service guide for some of the most commonly encountered system problems. Problems that surface in many cases are faults associated with communication paths (cables, connectors, internal data and power buses, and so forth). At the I/O module level, the quickest way to determine and correct the problem is by replacement. When spare parts are not available, the following checks may provide a practical approach.

Using the I/O Module Operational Status LEDs

The Operational Status LEDs (red and green) on the front of the I/O modules (see Figure 6-2) indicate the modules' operational status.

Red off, Green off

When all LEDs are off, this typically indicates loss of dc power. Perform the following checks.

1. If other module(s) in the modular base/extension unit are operating correctly, then:
   - Cycle power to the failed I/O module off then on by pulling the module from the unit and pushing the module back on the unit.
   - Replace the failed I/O module with a known good module to test that slot in the unit (see "Replacing a Failed ISCM or I/O Module" on page 127).

Otherwise, perform the following checks:

2. Use a multimeter to verify that the dc voltage at the input terminals of the unit is within the range of 21.6 to 25.2 V dc.
3. Verify that the power cable is firmly connected to the unit and 24 V dc power supply.

4. If all modules on the unit have failed and the power supply is operating normally, disconnect the power cable from the power supply and unit, and use a multimeter to verify continuity of the cable conductors, or replace the cable.

Red flashing, Green on

Until the ISCM is communicating with the I/O module through the base/extension unit, the I/O module flashes its red LED. Once communication has been established, the module turns off the red LED unless there is a fault in the I/O module. If this state persists, the module is most likely at fault and should be replaced. If this state exists on all I/O modules, then the ISCM or the base/extension unit is at fault and should be replaced.

Red off, Green on

When the red LED is off and the green LED is on, this indicates that the module is functional without fault. This is the normal operating state of the I/O module.

Red on, Green on

When the red and green LEDs are on, this indicates that the module either has detected a line fault (open or short circuit) or has detected a fatal internal fault. In addition, analog output modules with line fault detection may be in this state if the output is sent to a value below 1 milliamp. Check the output value and connections to determine if the module is OK or at fault. If all wiring is OK, replace the module.

Replacing a Failed ISCM or I/O Module

ISCMs can be hot-swapped under the following considerations:

- Any ISCM can be removed or replaced with the power on without causing damage to the module. See the WARNING below. (Care must be exercised, however, to ensure that process operations are not disrupted.)
- For a redundant ISCM pair, either module in the pair can be removed at any time without disrupting process operations. See the WARNING below. (The opposite module takes over control immediately.)
- When replacing a redundant ISCM, set the letterbug switch carefully and be sure it matches its redundant partner or it will not operate correctly and could cause operational issues with the attached modules or ISCMs in the system.
  When replacing a failed ISCM, wait a minimum of 45 seconds after removing the ISCM before installing the new replacement ISCM. This is necessary to allow the ISCM that is still running to initialize its redundancy data structures properly for the addition of its redundant partner.

⚠ WARNING

To prevent explosion, **do not** install or remove cables, wiring, modules, or other replaceable system components in hazardous locations. Remove power to the equipment at the source or ensure that the atmosphere is non-explosive before installing or removing any electrical component.
I/O modules which only have intrinsically safe front end connectors may be inserted or removed under normal operating conditions without the need for a hot work permit. In Zone 1 environments, the P+F removal tool must be used for the purpose, as discussed in *FB Remote I/O Bus System Hardware* (acquired as discussed in "P+F Intrinsically Safe I/O Modules Overview Specifications" on page xv).

If the failed module's red LED turns on or flashes, this is an indication of one of two failure modes:

- Either module in a redundant pair has failed.
- If the ISCM is a single ISCM or a redundant Master, and one of the P+F I/O modules has line fault detection and has a short or open line fault.

If this occurs, proceed with the following checks. (These checks need not be followed in order.)

1. Make sure that the HDLC cables are correctly connected to the base/extension unit(s).
2. Check for error messages at the system printer.
3. Check System Management for diagnostic information.
4. Replace the module if all else fails.

To replace a failed ISCM or I/O module, refer to the following documents:

- For Zone 1 environments, the section "Insertion / Swapping" in *FB Remote I/O Bus System Hardware*
- For Zone 2 environments, the section "Inserting and removing I/O modules, com units, and power supplies" in *LB Remote I/O Bus System Hardware*

To locate these documents on Pepperl+Fuchs' website, refer to "P+F Intrinsically Safe I/O Modules Overview Specifications" on page xv.

After the new ISCM module is installed, it automatically boots up, acquires its configuration database from the master module and comes on-line as the tracker module. This operation may take a few minutes before the newly inserted ISCM comes back on-line.

After a new I/O module is installed, the ISCM automatically will reconfigure it and bring it on-line.

Replacing a Defective HDLC Cable

A third HDLC cable connector is provided on the LB-style base unit to allow replacement of a defective HDLC cable without interrupting communications to other LB-style units in the chain. The procedure to do this follows:

1. If the defective cable is connected between the FCP (or FCM) baseplate and the first LB-style base unit, remove the terminator from this baseplate. Plug the replacement

HDLC cable into this connector and into the unused connector on the first LB-style base unit. Then, remove the defective HDLC cable and reinstall the terminator on the FCP270 (or FCM) baseplate.

2. If the defective cable is between two LB-style base units, install the replacement cable in the third connector on each of these base units. Then remove the defective HDLC cable from the two base units.

Replacement of a defective HDLC cable on the FB-style system does not require any special procedure, since the "A" and "B" busses are in separate cables.

⚠ WARNING

A hot work permit is required for maintenance on non-intrinsically safe (NON-IS) wiring in Zone 1 hazardous areas.

Diagnostics

NOTE

There are no user scheduled diagnostics required for the ISCM.

Start-up diagnostics run every time the module is powered up or restarted. Start-up diagnostics test the basic core functionality of the module prior to going on-line. The start-up diagnostics complete in approximately five seconds. A failure is indicated by the flashing of the red LED when there are no failed I/O modules attached. System Management may also display diagnostic information. The ISCM will perform the following tasks during startup:

1. RAM memory test
2. Scheduling timer test
3. HDLC controller test
4. ROM checksum test
5. Dual ported shared RAM test

Technical Support

If technical support is needed, call the IOM Global Customer Support Center at 1-866-746-6477 or online at *http://support.ips.invensys.com*.

Module Return Procedure

Contact the IOM Global Customer Support Center at 1-866-746-6477 or online at *http://support.ips.invensys.com* for information regarding the return of the ISCM or the supported P+F intrinsically safe I/O modules.

Appendix A. CP270 to ISCM Connection Diagrams

This Appendix contains cabling diagrams for connecting the FCP270 and ZCP270 control processors to the ISCM.

The figures in this Appendix illustrate typical configurations for connecting the FCP270 and ZCP270 control processors to the ISCM, including their parts and cables necessary to interconnect the various modules. The illustrations are as follows:

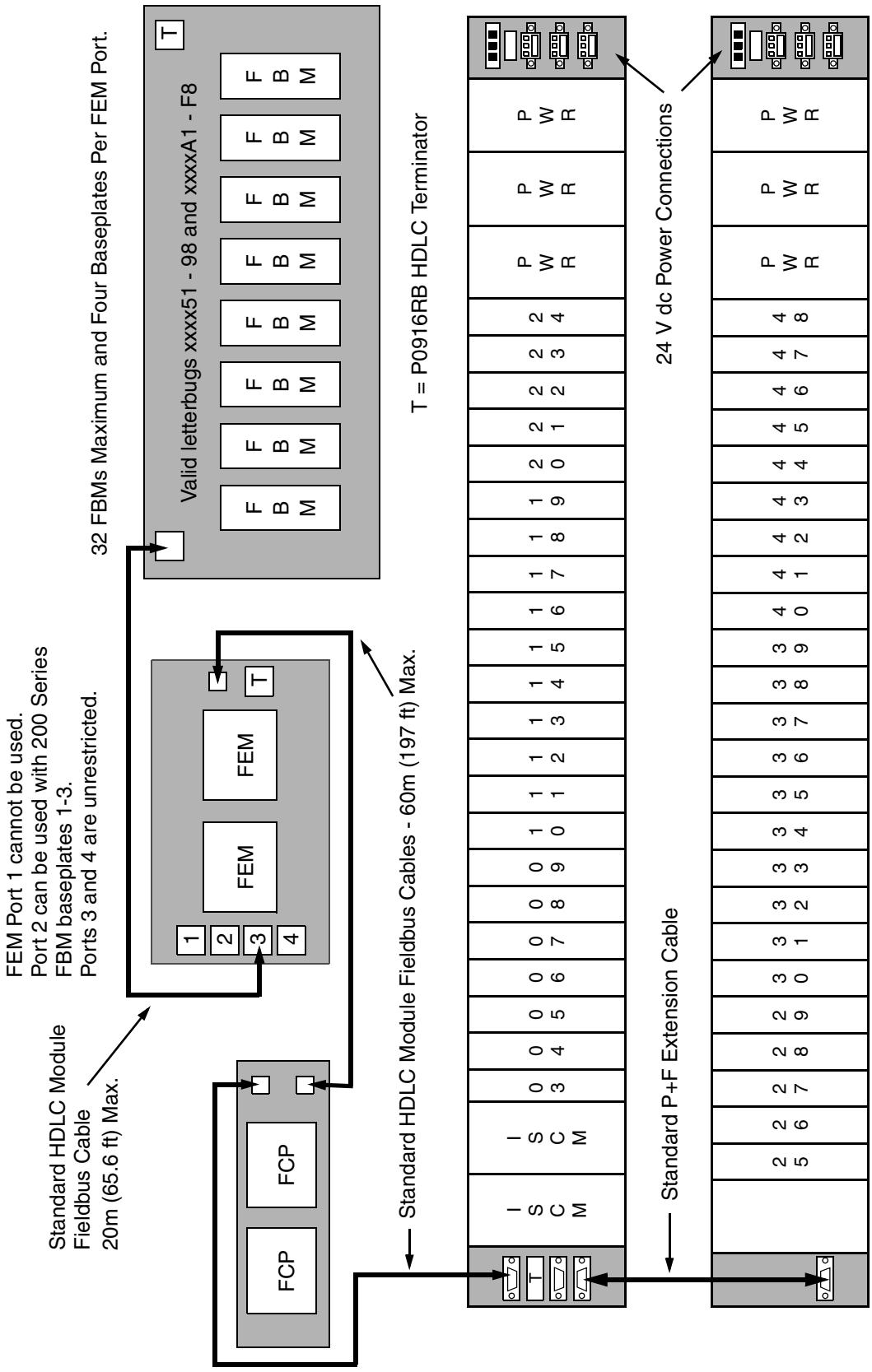


Figure A-1. Zone 2 (LB-Style) ISCM/FBM Configuration with FCPs and FEM100s

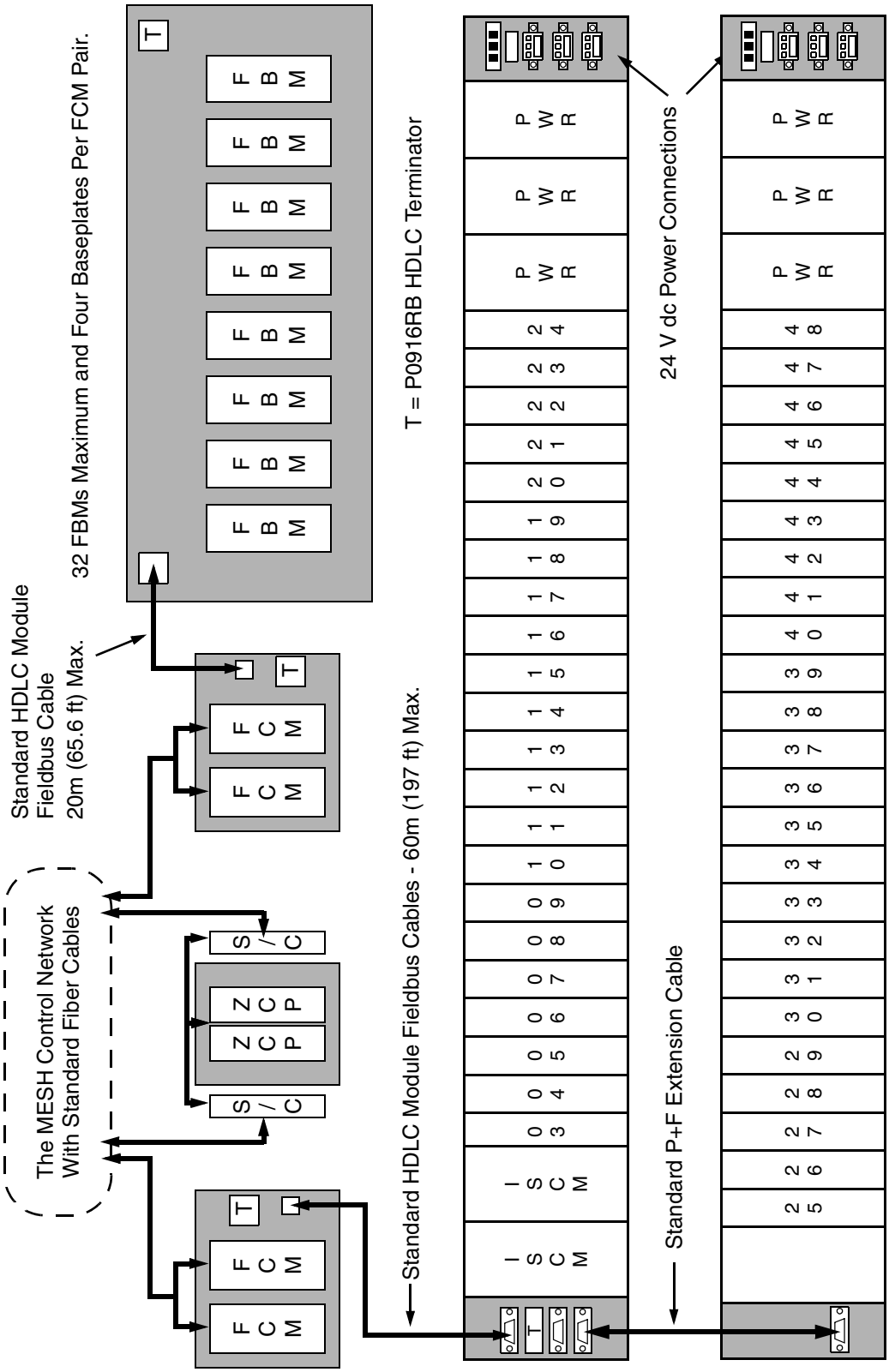


Figure A-2. Zone 2 (LB-Style) ISCM/FBM Configuration with ZCPs and FCM100E/Ets

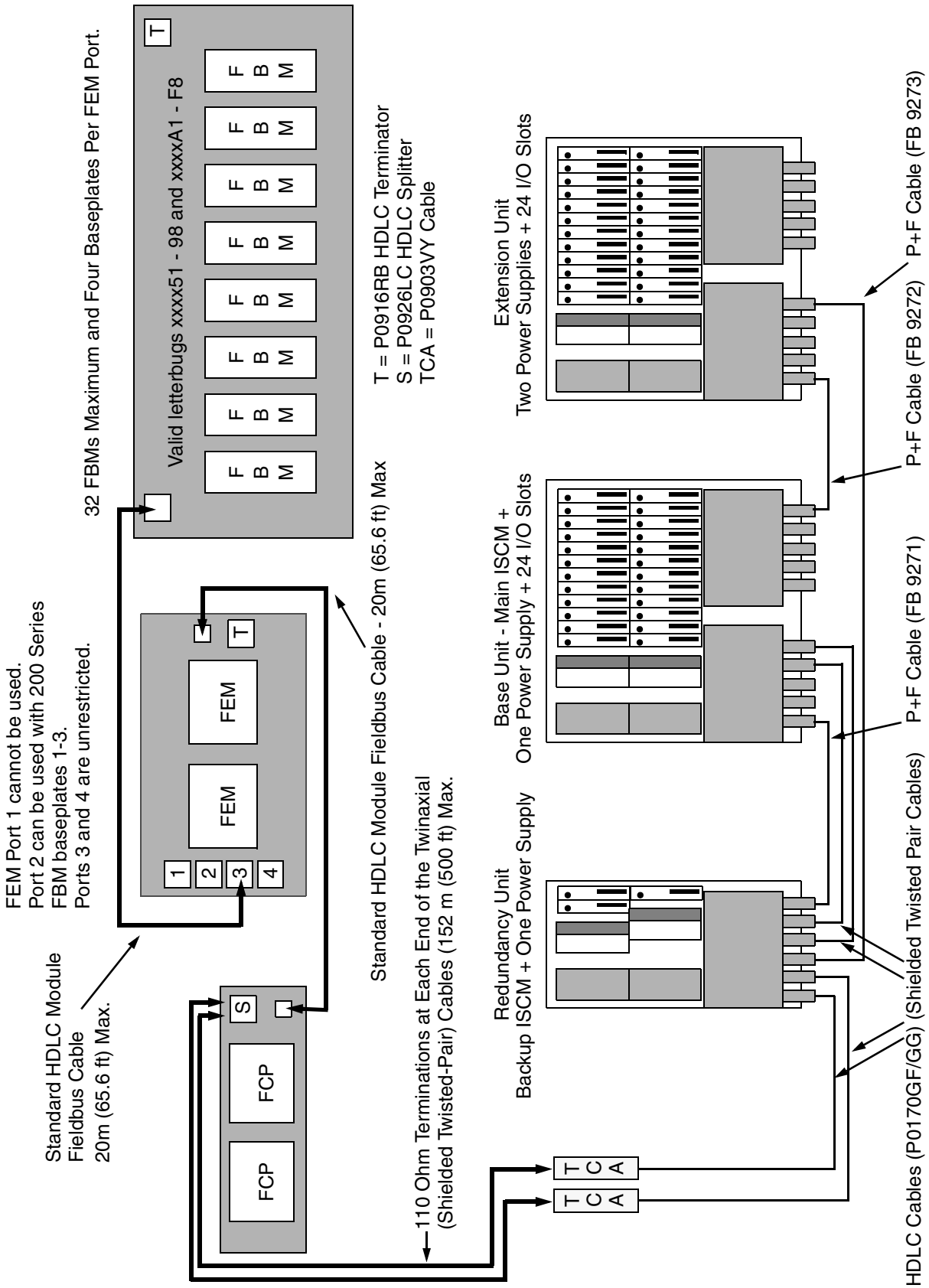


Figure A-3. Zone 1 (FB-Style) ISCM/FBM Configuration with ZCPs and FEM100s

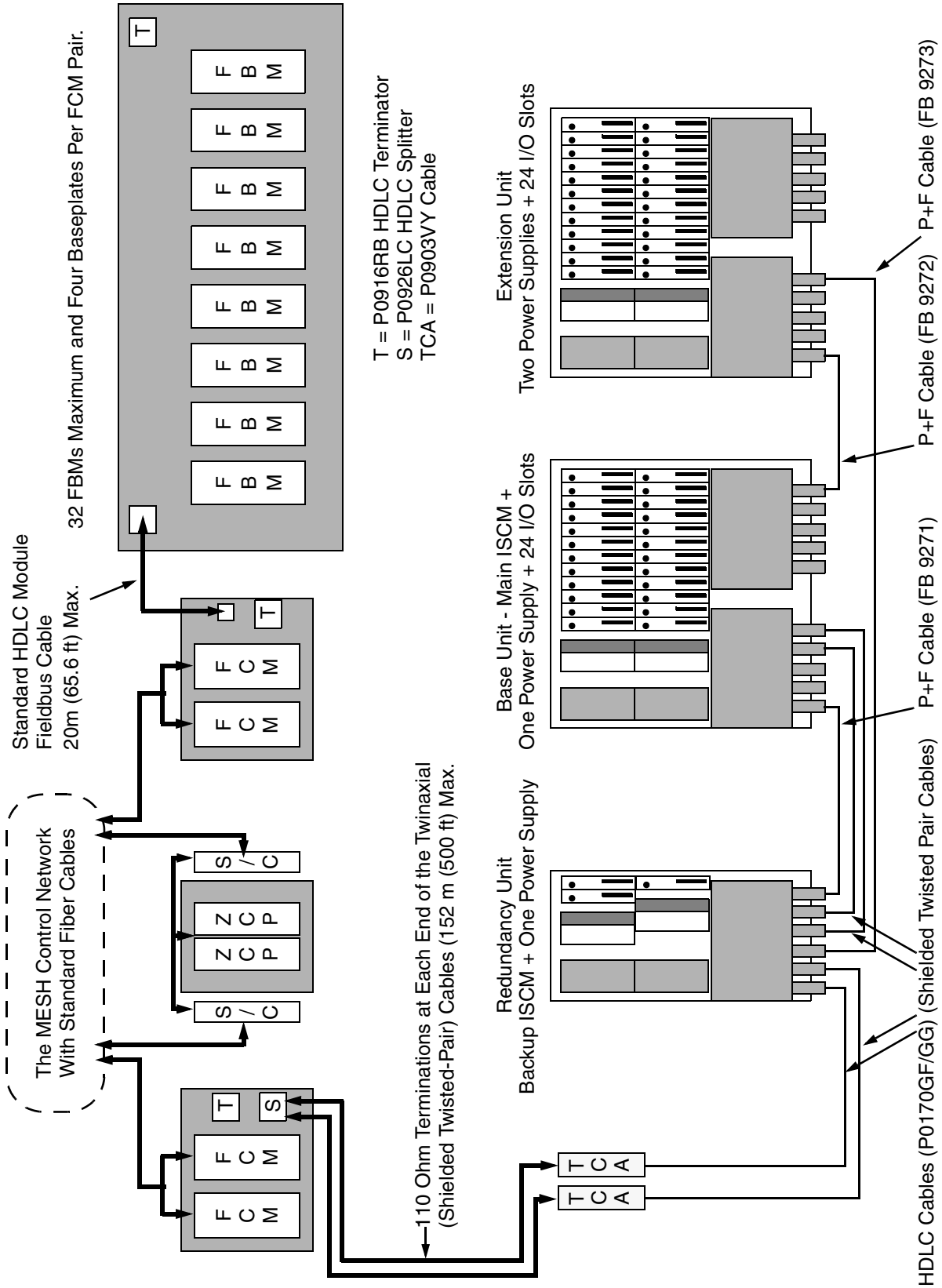


Figure A-4. Zone 1 (FB-Style) ISCM/FBM Configuration with ZCPs and FCM100E/Ets

Appendix B. Module I/O Connections

This Appendix contains illustrations of the I/O connections for the P+F Intrinsically Safe I/O modules created for Invensys, outside of the Pepperl+Fuchs' typical product line.

Intrinsically Safe Communication Module Input Connections

Figure B-1 illustrates the input connections of the ISCM for Zone 2 (LB-style) applications.

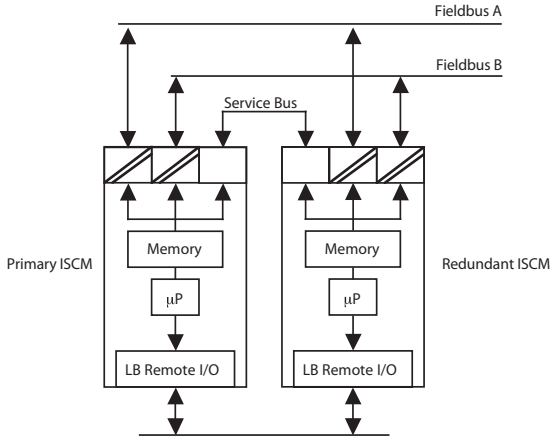


Figure B-1. ISCM for Zone 2 (LB-Style) Applications (P0924GT) Input Connections

Figure B-2 illustrates the input connections of the ISCM for Zone 1 (FB-style) applications.

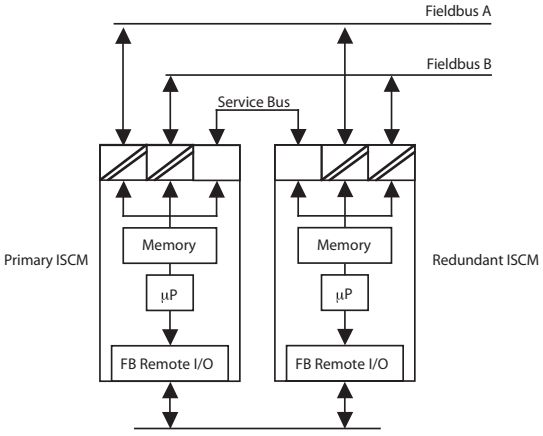


Figure B-2. ISCM for Zone 1 (FB-Style) Applications (P0924GU) Input Connections

NOTE

The service bus is reserved for service personnel only. It may be connected only in the absence of explosive atmospheres (e.g. obtaining a hot work permit).

LB-Style P+F Intrinsically Safe Module Input Connections

The input connections for the following LB-style P+F intrinsically safe modules (all input only) are provided below:

LB 1103 F - Frequency Input Module Connections

Figure B-3 illustrates the input connections of the LB 1103 F frequency input with direction of rotation module.

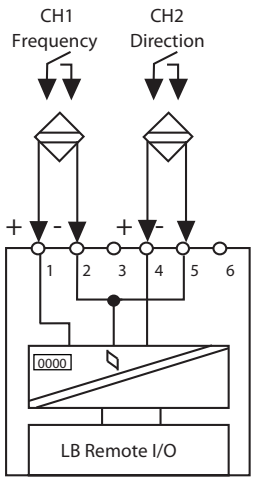


Figure B-3. LB 1103 F Input Connections

LB 1103 FL - Low Frequency Input Connections

Figure B-4 illustrates the input connections of the LB 1103 FL low frequency input with direction of rotation module.

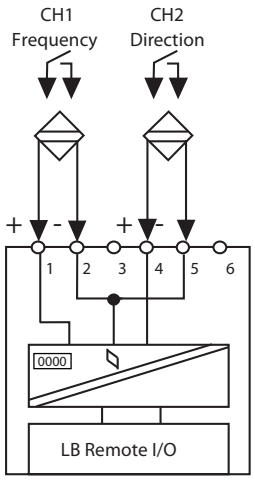


Figure B-4. LB 1103 FL Input Connections

LB 1104 F - Pulse Count Input Connections

Figure B-5 illustrates the input connections of the LB 1104 F pulse count input with direction of rotation module.

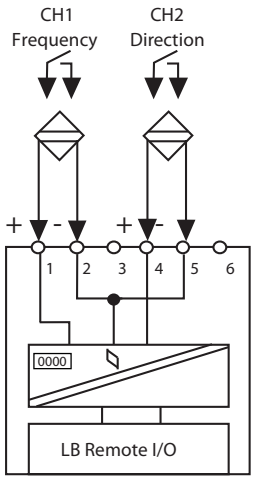


Figure B-5. LB 1104 F Input I/O Connections

LB 1104 FL - Low Frequency Pulse Count Input Connections

Figure B-6 illustrates the input connections of the LB 1104 FL low frequency pulse count input with direction of rotation module.

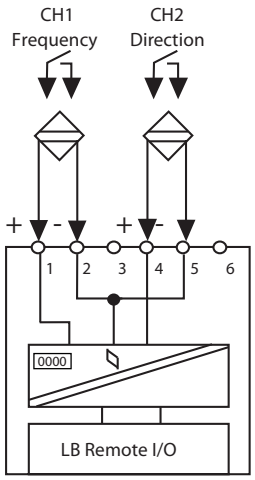


Figure B-6. LB 1104 FL Input Connections

LB 5101 F3 - 2 or 3-Wire RTD Input Connections

Figure B-7 illustrates the input connections of the LB 5101 F3 2 or 3-wire RTD input module.

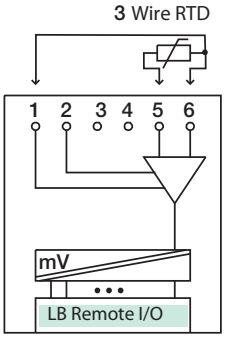


Figure B-7. LB 5101 F3 Input I/O Connections

LB 5101 F4 - 4-Wire RTD Input Connections

Figure B-8 illustrates the input connections of the LB 5101 F4 4-wire RTD I/O module.

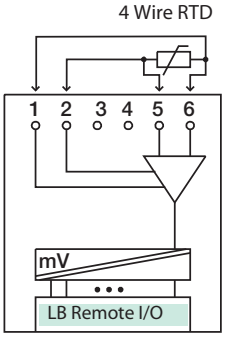


Figure B-8. LB 5101 F4 Input Connections

LB 5102 F - Thermocouple Input Connections

Figure B-9 illustrates the input connections of the LB 5102 F Thermocouple input module with cold junction compensation.

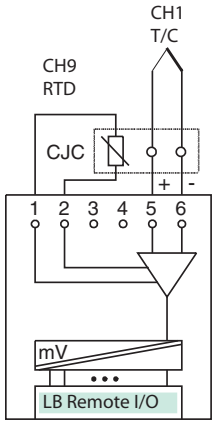


Figure B-9. LB 5102 F Input I/O Connections

LB 5104 F3 - 2 or 3-Wire RTD Input Connections

Figure B-10 illustrates the input connections of the LB 5104 F3 3-wire RTD input module.

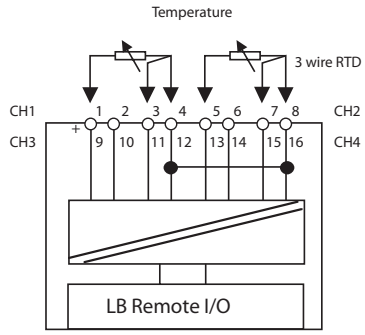


Figure B-10. LB 5104 F3 Input Connections

LB 5104 F4 - 4-Wire RTD Input Connections

Figure B-11 illustrates the input connections of the LB 5104 F4 4-wire RTD input module.

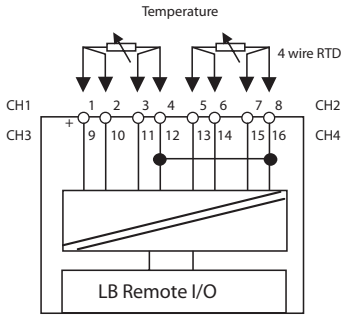


Figure B-11. LB 5104 F4 Input Connections

LB 5105 F - Thermocouple Input Connections

Figure B-12 illustrates the input connections of the LB 5105 F Thermocouple input module with cold junction compensation.

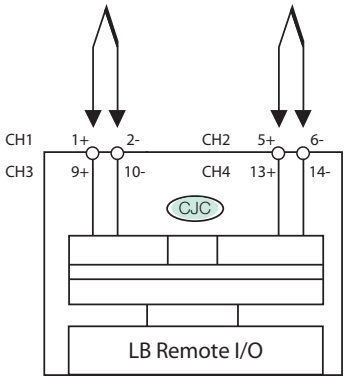


Figure B-12. LB 5105 F Input I/O Connections

FB-Style P+F Intrinsically Safe Module Input Connections

The input connections for the following FB-style P+F intrinsically safe modules (all input only) are provided below:

FB 1203 F - Frequency Input Connections

Figure B-13 illustrates the input connections of the FB 1203 F frequency input with direction of rotation module.

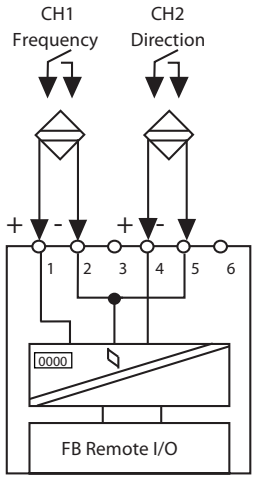


Figure B-13. FB 1203 F Input Connections

FB 1203 FL - Low Frequency Input Connections

Figure B-14 illustrates the input connections of the FB 1203 FL low frequency input with direction of rotation module.

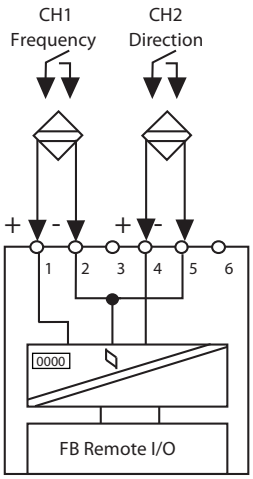


Figure B-14. FB 1203 FL Input I/O Connections

FB 1204 F - Pulse Count Input Connections

Figure B-15 illustrates the input connections of the FB 1204 F pulse count input with direction of rotation module.

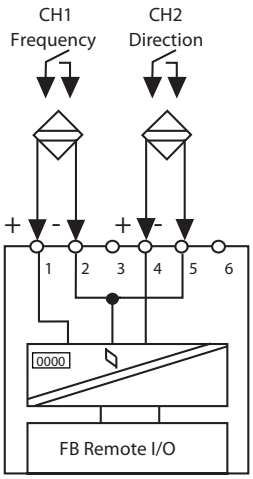


Figure B-15. FB 1204 F Input I/O Connections

FB 1204 FL - Low Frequency Pulse Count Input Connections

Figure B-16 illustrates the input connections of the FB 1204 FL low frequency pulse count input with direction of rotation module.

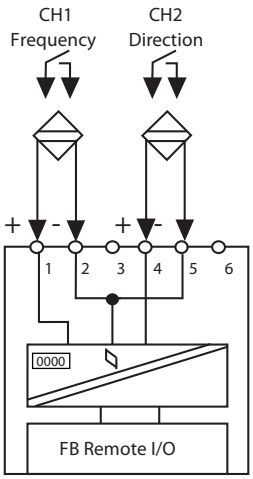


Figure B-16. FB 1204 FL Input Connections

FB 1303 F and FB 1303 F2 - Frequency Ex-e Input Connections

Figure B-17 illustrates the input connections of the FB 1303 F and FB 1303 F2 frequency Ex-e input with direction of rotation modules.

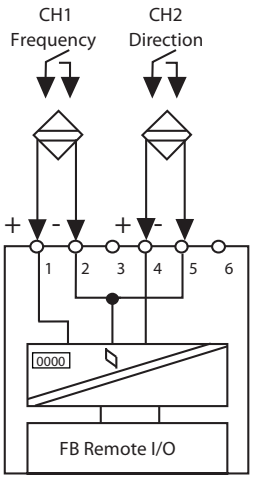


Figure B-17. FB 1303 F and FB 1303 F2 Input Connections

FB 1303 FL and FB 1303 FL2 - Low Frequency Ex-e Input Connections

Figure B-18 illustrates the input connections of the FB 1303 FL and FB 1303 FL2 low frequency Ex-e input with direction of rotation modules.

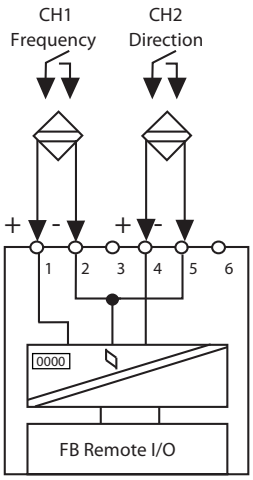


Figure B-18. FB 1303 FL and FB 1303 FL2 Input Connections

FB 1304 F and FB 1304 F2 - Pulse Count Ex-e Input Connections

Figure B-19 illustrates the input connections of the FB 1304 F and FB 1304 F2 pulse count Ex-e input with direction of rotation modules.

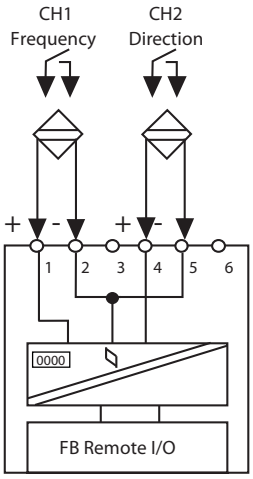


Figure B-19. FB 1304 F and FB 1304 F2 Input Connections

FB 1304 FL and FB 1304 FL2 - Low Frequency Pulse Count Input Connections

Figure B-20 illustrates the input connections of the FB 1304 FL and FB 1304 FL2 low frequency pulse count Ex-e input with direction of rotation modules.

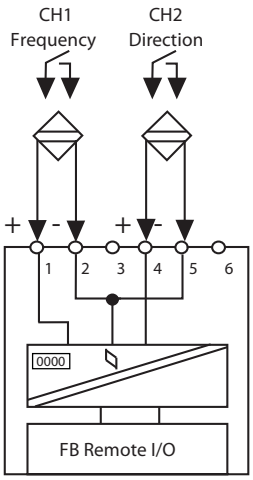


Figure B-20. FB 1304 FL and FB 1304 FL2 Input Connections

FB 5201 F3 - 2 or 3-Wire RTD Input Connections

Figure B-21 illustrates the input connections of the FB 5201 F3 2 or 3-wire RTD input module.

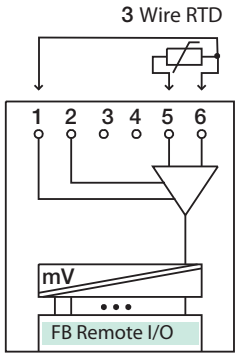


Figure B-21. FB 5201 F3 Input Connections

FB 5201 F4 - 4-Wire RTD Input Connections

Figure B-22 illustrates the input connections of the FB 5201 F4 4-wire RTD input module.

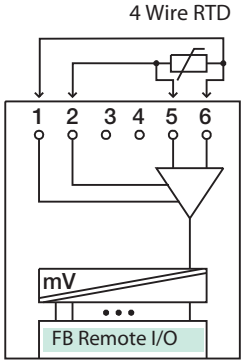


Figure B-22. FB 5201 F4 Input Connections

FB 5202 F - Thermocouple Input Connections

Figure B-23 illustrates the input connections of the FB 5202 F Thermocouple input module with cold junction compensation.

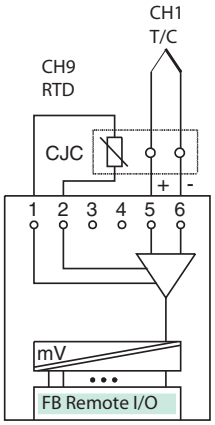


Figure B-23. FB 5202 F Input Connections

FB 5204 F3 - 2 or 3-Wire RTD Input Connections

Figure B-24 illustrates the input connections of the FB 5204 F3 2 or 3-wire RTD input module.

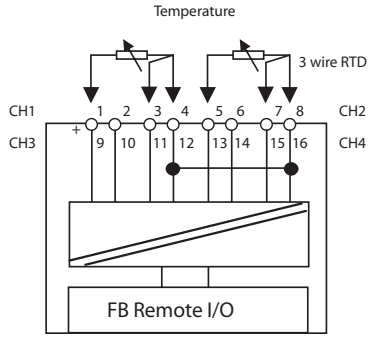


Figure B-24. FB 5204 F3 Input Connections

FB 5204 F4 - 4-Wire RTD Input Connections

Figure B-25 illustrates the input connections of the FB 5204 F4 4-wire RTD input module.

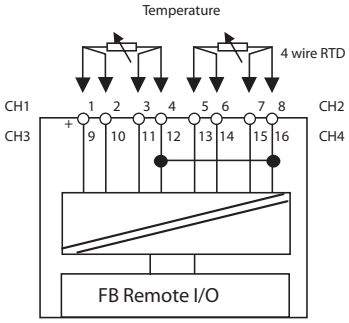


Figure B-25. FB 5204 F4 Input Connections

FB 5205 F - Thermocouple Input Connections

Figure B-26 illustrates the input connections of the FB 5205 F Thermocouple input module with cold junction compensation.

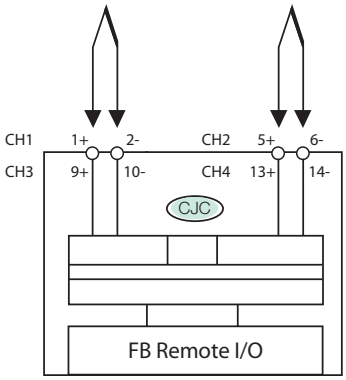


Figure B-26. FB 5205 F Input Connections

Appendix C. ICC Configuration Screens for ISCM and P+F I/O Modules

This appendix contains screenshots of the ISCM and LB-Style P+F I/O modules configured in ICC. It is provided as a supplement to Chapter 4 "Configuration Information".

ICC Configuration Screens for ISCM

Figure C-1 and Figure C-2 provide examples of how to configure ECBs for a single or redundant ISCM, respectively, in ICC.

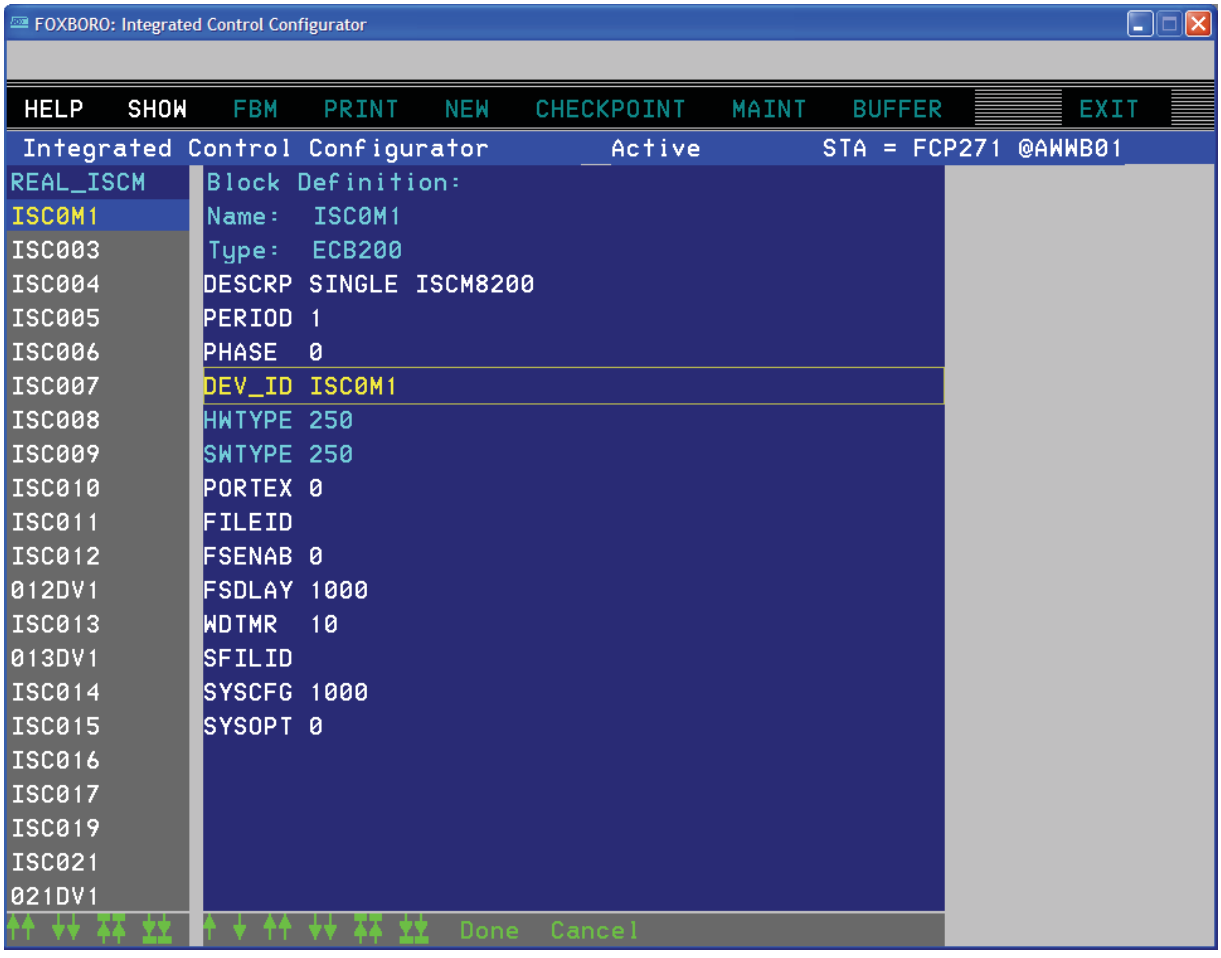


Figure C-1. Creating an ECB200 for a Single ISCM in ICC (Example)

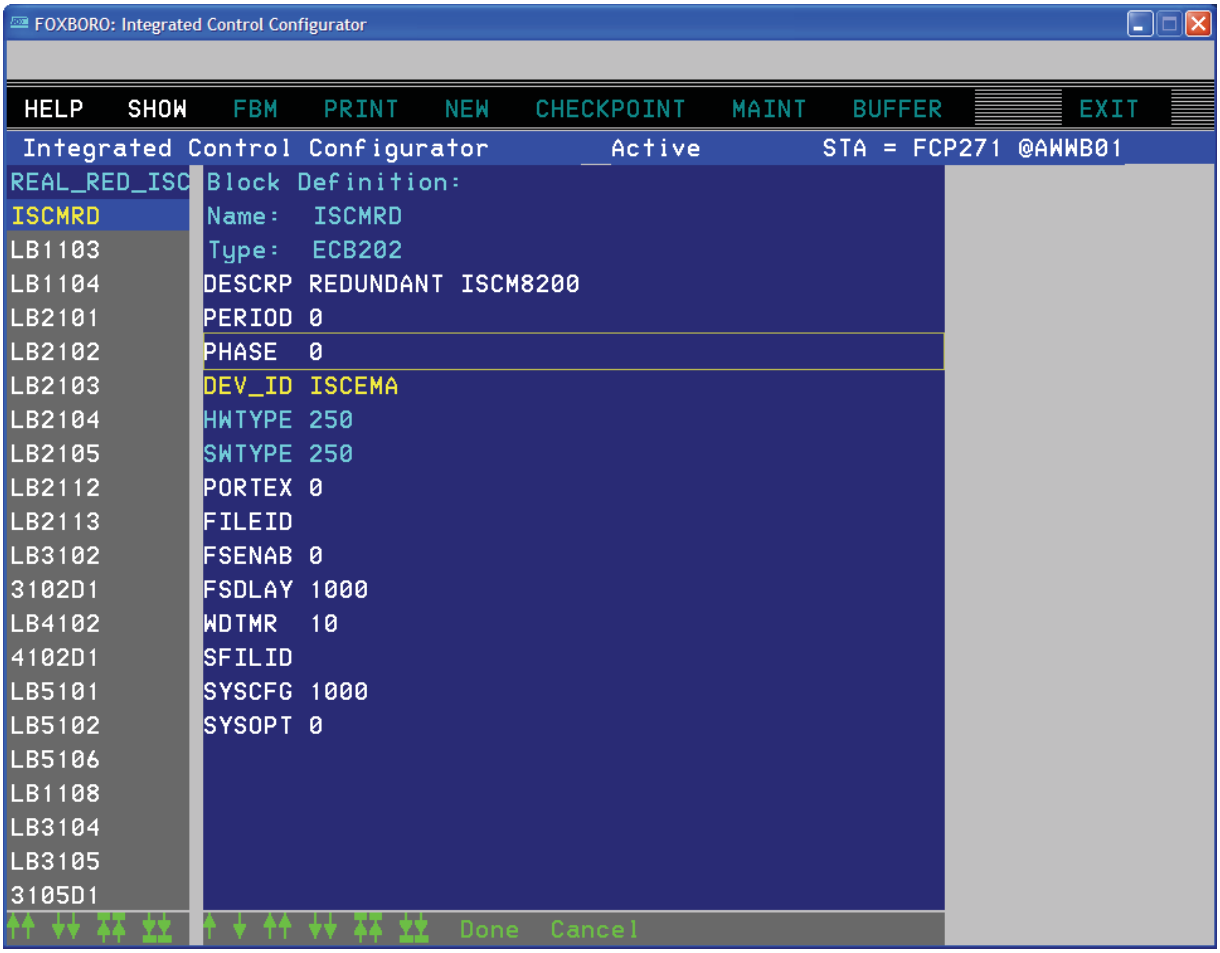


Figure C-2. Creating an ECB202 for a Redundant ISCM in ICC (Example)

ICC Configuration Screens for LB-Style I/O Modules

Figure C-3 and Figure C-4 provide examples of how to configure ECBs for Zone 2 I/O modules in ICC.

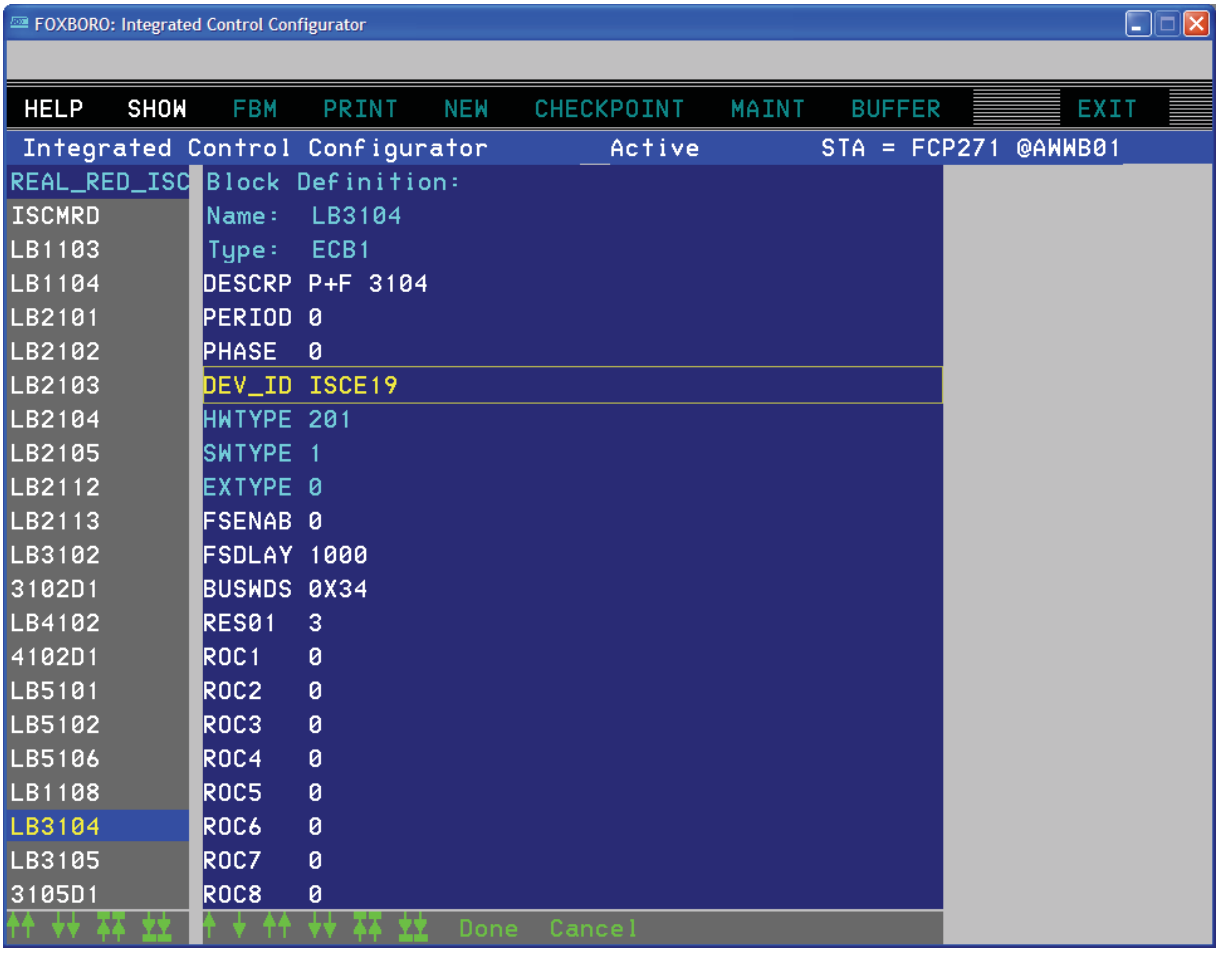


Figure C-3. Creating an ECB1 for a LB 3104 Module (Example)

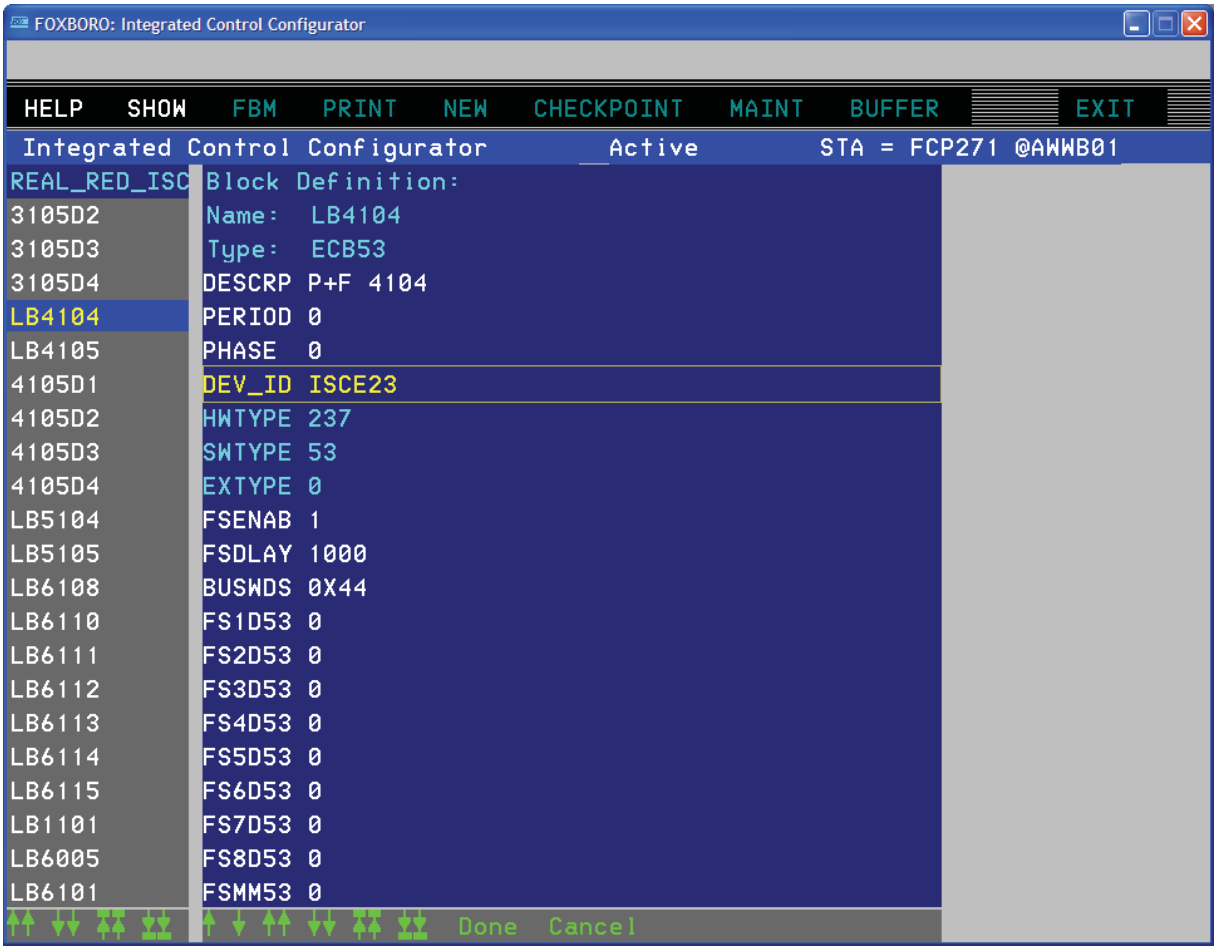


Figure C-4. Creating an EC53 for a LB 4104 Module (Example)

ICC Configuration Screens for LB-Style HART I/O Modules

Figure C-3 and Figure C-4 provide examples of how to configure ECBs for Zone 2 HART I/O modules in ICC.

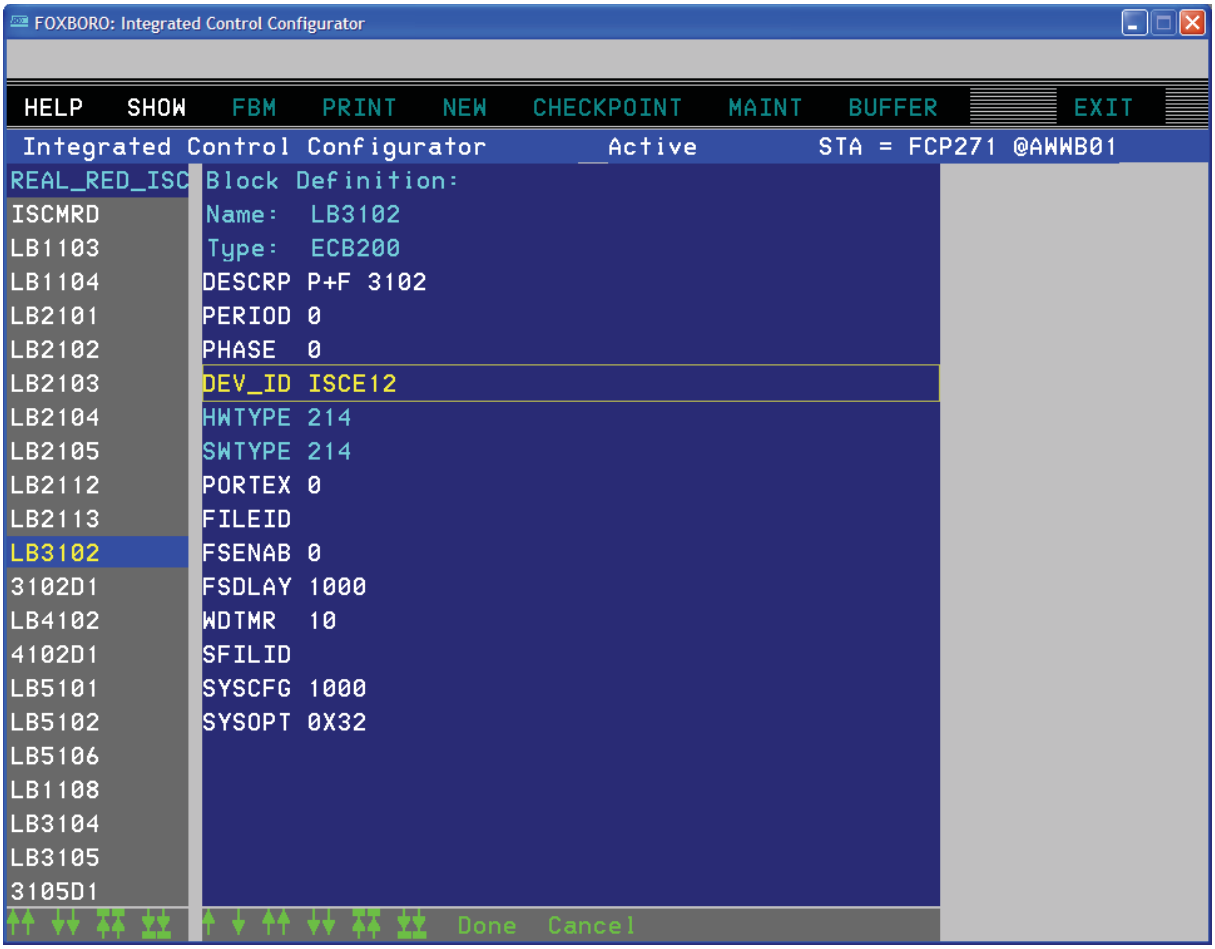


Figure C-5. Creating an ECB200 for a LB 3102 Module (Example)

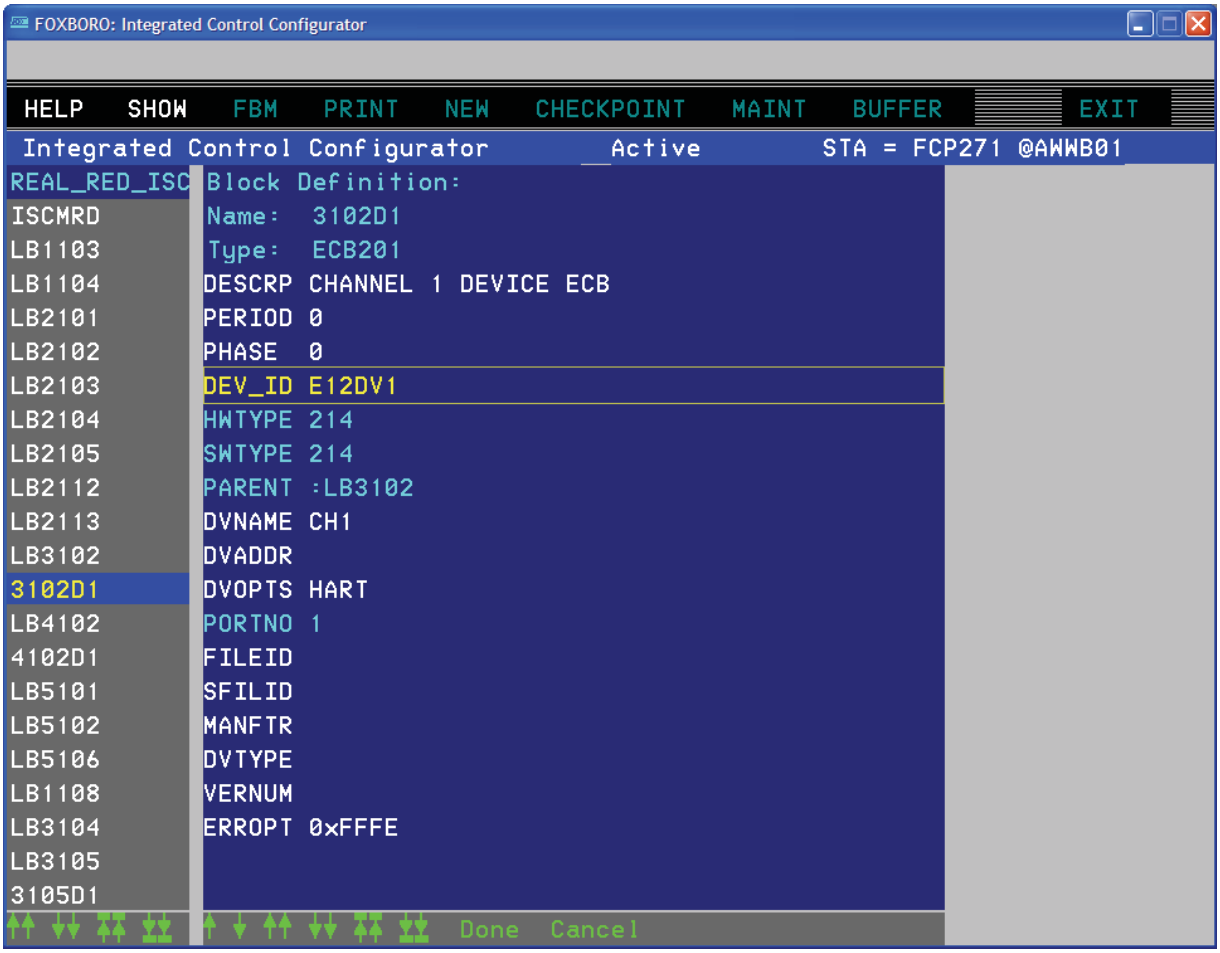


Figure C-6. Creating an Device ECB201 for a LB 3102 Module (Example)

Index

Invensys Operations Management
5601 Granite Parkway Suite 1000
Plano, TX 75024
United States of America
http://www.iom.invensys.com

Global Customer Support
Inside U.S.: 1-866-746-6477
Outside U.S.: 1-508-549-2424 or contact your local Invensys representative.
Email: iom.support@invensys.com
Website: http://support.ips.invensys.com