GFK-1213

GE Fanuc Manual Series 90-30

FIP Bus Controller

GE Fanuc Automation

Programmable Control Products

Series 90™ -30 FIP Bus Controller

User's Manual

GFK-1213 March 1996

GFL–002

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

GE Fanuc Automation makes no representation or warranty, expressed, implied, or statutory with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warranties of merchantability or fitness for purpose shall apply.

The following are trademarks of GE Fanuc Automation North America, Inc.

Alarm Master	GEnet	PowerMotion	Series One
CIMPLICITY	Genius	ProLoop	Series Six
CIMPLICITY PowerTRAC	Genius PowerTRAC	PROMACRO	Series Three
CIMPLICITY 90–ADS	Helpmate	Series Five	VuMaster
CIMSTAR	Logicmaster	Series 90	Workmaster
Field Control	Modelmaster		

Preface

Content of this Manual

Chapter 1. Introduction: This chapter describes the Series 90™-30 PLC FIP Bus Controller (FBC).

Chapter 2. Installation: This chapter explains how to install and remove the Bus Controller, connect the FIP bus, observe the LEDs, and upgrade the Bus Controller firmware

Chapter 3. Hand-held Programmer Configuration: This chapter explains the Hand-held Programmer configuration steps for a FIP Bus Controller.

Chapter 4. Configuration and Operating Modes: This chapter describes the characteristics of Configuration modes 10 and 11.

Chapter 5. Diagnostics: This chapter describes the contents of the *Statfbc* COMV.

Appendix A: Description of COMVs: This appendix contains detailed description of the COMVs used in the various functions of the FIP Bus Controller (FBC).

Appendix B: Examples. This appendix includes two examples which are common to Configuration modes 10 and 11.

Related Publications

For more information, refer to these publications:

Series 90 ™-30 FIP Remote I/O Scanner User's Manual (GFK-1038). This book is a reference for installing, configuring, and using a GE Fanuc Series 90™-30 FIP Remote I/O Scanner.

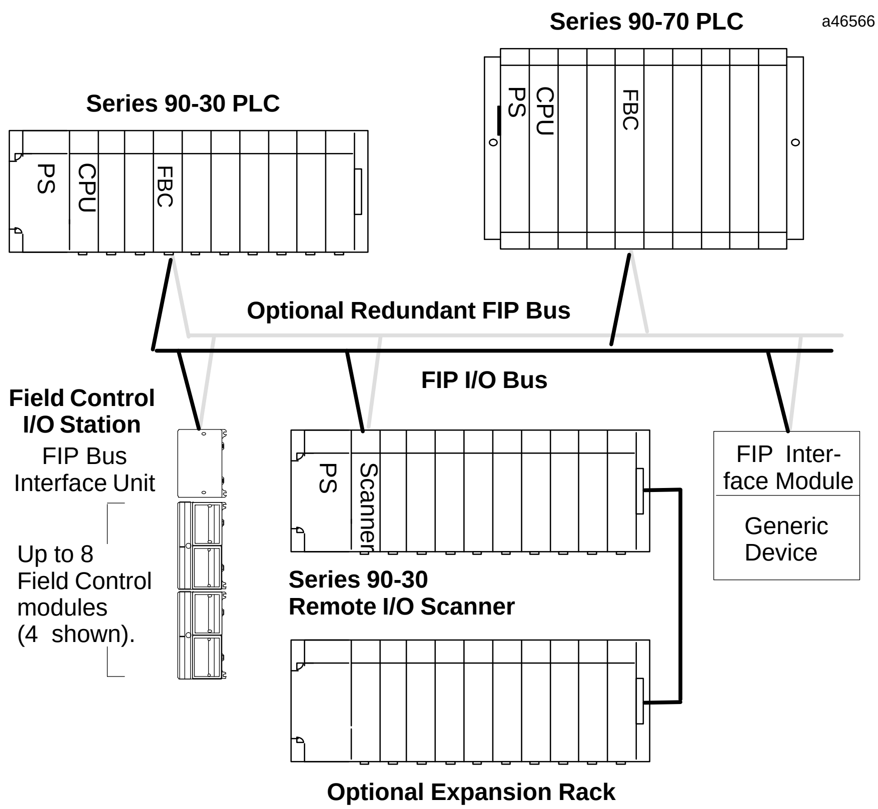
Series 90 ™-70 FIP Bus Controller User's Manual (GFK-1038). Reference manual for the Bus Controller, which interfaces a FIP bus to a Series 90-70 PLC. This book describes the installation and operation of the Bus Controller. It also contains the programming information needed to interface FIP devices to a Series 90-70 PLC.

FIP Bus Interface Unit User's Manual (GFK-1175). This manual describes the Field Control™ FIP Bus Interface Unit. It explains operation of the Bus Interface Unit as a FIP bus device.

Contents

Chapter 1
Introduction

The Series 90-30 PLC FIP Bus Controller (catalog number IC693BEM340) is used to interface a FIP I/O network to a Series 90-30 PLC.

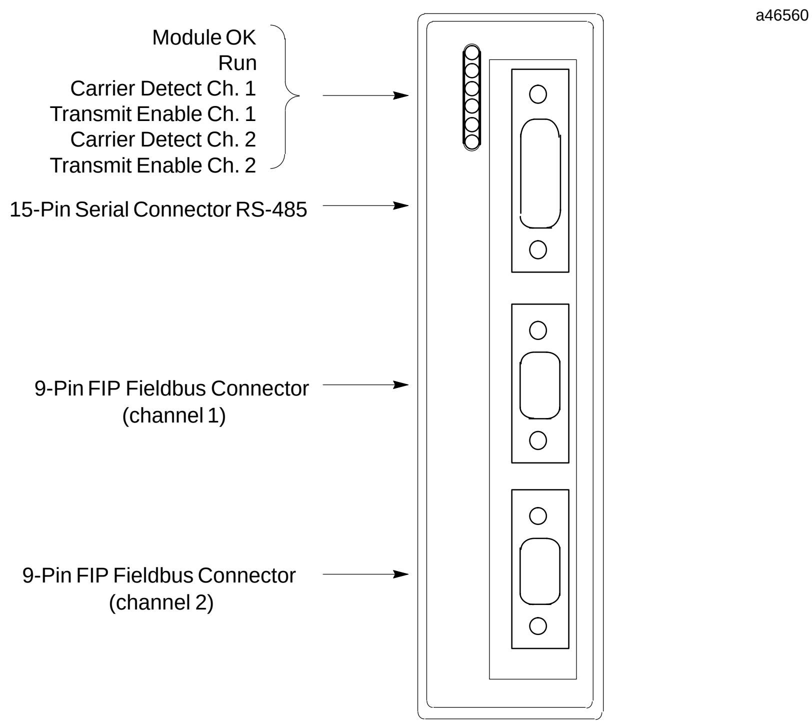


A FIP bus is used to connect different types of devices on the FIP network:

- **Series 90-70 PLC**, interfaced to a FIP bus by a Fip Bus Controller.
- **Field Control Stations**, Field Control I/O modules that are interfaced to the bus via a FIP Bus Interface Unit (BIU).
- **Remote Drops**, Series 90-30 I/O racks that are interfaced to the bus via FIP Remote I/O Scanner Modules. Each remote drop can have one 5- or 10-slot main rack, one 5- or 10-slot expansion rack and any mix of discrete and analog I/O modules.
- **Generic Devices**, such as general-purpose computers that are interfaced to the bus via a FIP Interface Module.
- **Variable speed drives**.

FIP Bus Controller Description

The FIP Bus Controller is a standard, rack-mounted Series 90-30 PLC module. It plugs easily into the PLC's backplane. The latch on the bottom of the module secures it in position.



There are no DIP switches or jumpers to set on the module.

The Series 90-30 FIP Bus Controller has six status LEDs, an RS-485 serial port, and two identical FIP bus connectors.

Status LEDs

The 6 LEDs on the front of the FIP Bus Controller display module status and communications activity.

Serial Port

The 15-pin serial port is used to connect a programmer or computer for upgrading the operating firmware of the Bus Controller.

FIP Bus Connectors

The two 9-pin connectors on the FIP Bus Controller provide for attachment of one or two FIP busses. The two busses provide a redundant bus capability.

Module Specifications

Ordering information	IC693BEM340
Moduletype	Series 90–30 PLC module, providing FIP communications with other devices.
Quantity per PLC	As power supply will allow
Currentconsumption	1.2 Amps maximum, 800mA typical
Series 90–30 PLC, memory types for FIP data	%G, %I, %Q, %AI, %AQ, %R, %M, %T
Softwarediagnostics	Status bits, Fault Reporting to Series 90–30 PLC
Environmental:	
Operating temperature	0°C to +55°C (+32°F to +131°F)
Storage temperature	–25 °C to +70°C (–13°F to +158°F)
Humidity	5% to 95% (non–condensing)
Vibration and shock	0.2 inch displacement 5Hz to 10Hz 1 G 10Hz to 200Hz 5 G 10Ms duration

Compatibility

Minimum hardware configuration:

- Series 90-30 PLC baseplate
- Power supply
- CPU

Specific equipment or software versions required for compatibility with the FIP Bus Controller module are listed below.

CPU: The FIP Bus Controller can be used with all CPU models 311 – 351. The CPU firmware must be rel. 5.0 or later.

Control 90 Software: rel. 1.5 or later.

Chapter 2 Installation

This chapter describes:

- Module Installation
- Module Removal
- Connecting the FIP Bus to the Bus Controller
- Observing the LEDs
- Upgrading the Bus Controller Firmware

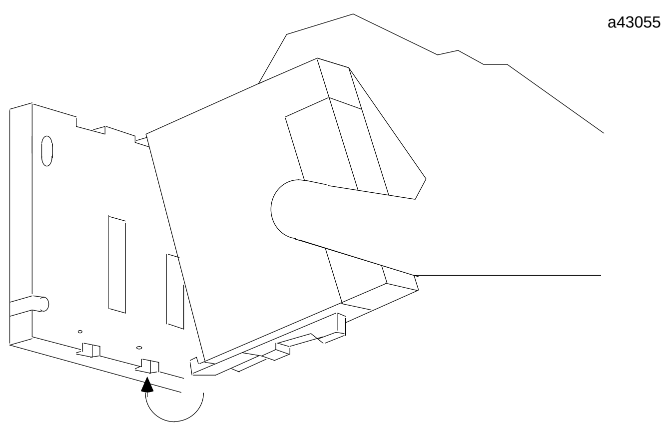
Module Installation

The FIP Bus Controller module can be located in any I/O slot in a Series 90–30 CPU rack or I/O rack, including remote racks. For best performance, the main rack is required.

Power must be OFF when installing or removing the module.

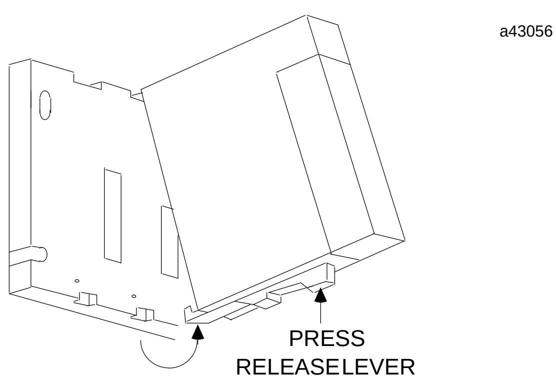
To install the Bus Controller in the Series 90–30 PLC backplate:

1. Grasp the module with the terminal board toward you and the rear hook facing away from you.
2. Align the module with the desired base slot and connector. Tilt the module upward so that the top rear hook on the module engages the slot on the baseplate.
3. Swing the module downward until the connectors mate and the locking lever on the bottom of the module snaps into place, engaging the baseplate notch.



Module Removal

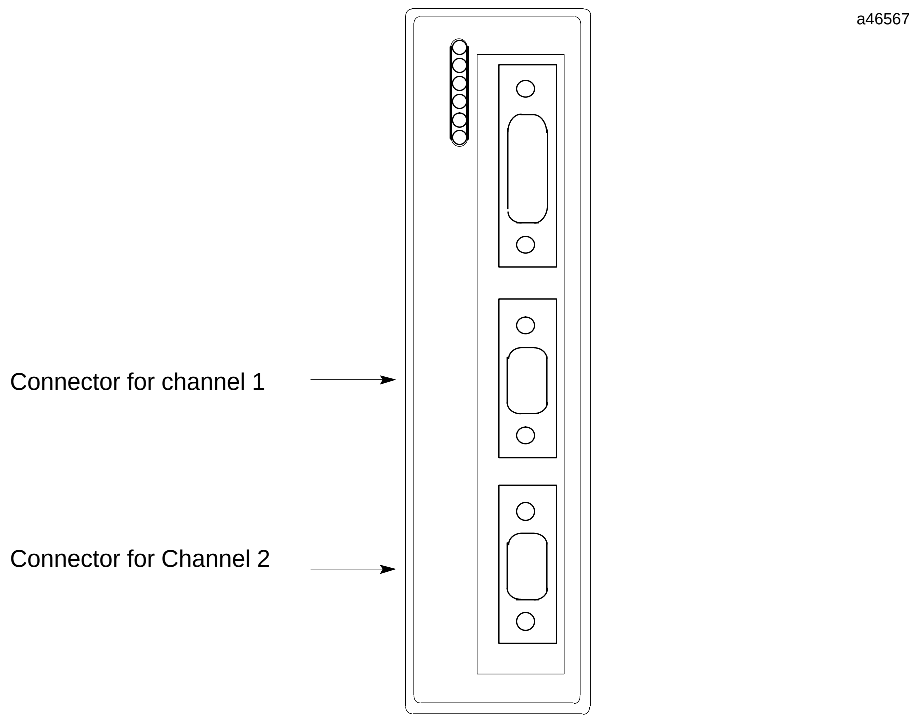
1. Locate the release lever on the bottom of the module. Firmly press it up toward the module.
2. While holding the module firmly at the top, continue fully depressing the release lever and swing the module upward.
3. Disengage the hook at the top of the module by raising the module up and moving it away from the baseplate.



Connecting the FIP Bus to the Bus Controller

Attach FIP bus cable(s) to the connectors on the front of the Bus Controller.

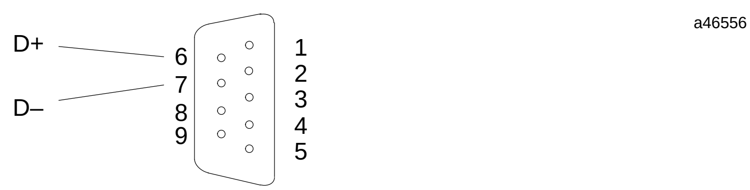
When installed in a single media or simplex configuration, either connector may be used. When installed in a dual media or redundant configuration, both the Channel 1 and 2 connectors must be used. Both connectors accept a standard 9-pin D-type male connector.



Note: If only one FIP bus is used, cover the unused FIP bus connector with an anti-static cap. The unused connector must be protected in this manner to meet IEEE specification 801.2.

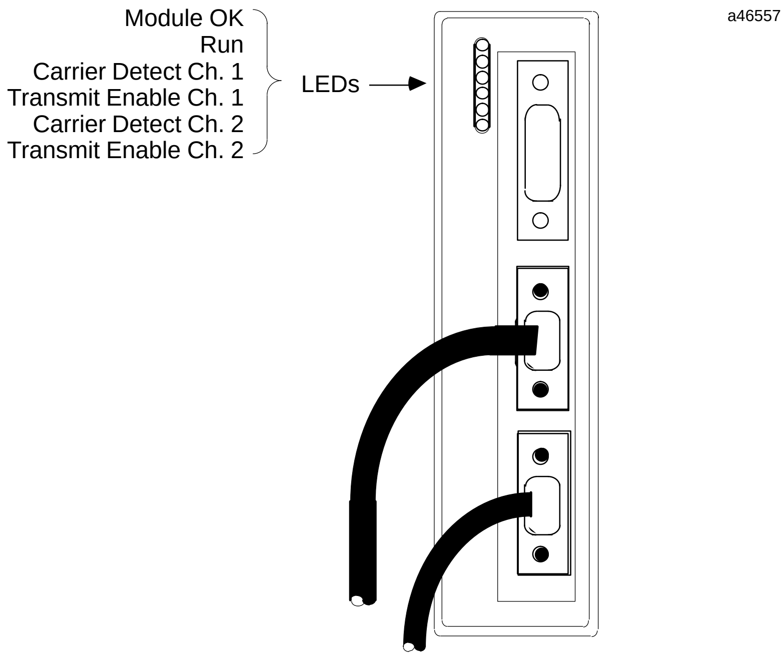
Pin Assignments for the FIP Bus Connectors

The diagram below shows pin assignments for both FIP bus connectors on the front of the Bus Controller.



Observing the LEDs

When power is applied, the LEDs on the Bus Controller indicate operating status.



The top LED indicates module health. The bottom five LEDs indicate communications activity on the FIP bus. Two LEDs are dedicated to each of the two FIP channels.

MODULE OK – Shows the status of the FIP Bus Controller. This LED blinks during power-up diagnostics and should remain on as long as power is applied to the Bus Controller.

RUN – Shows the operational status of the FIP Bus Controller. This LED turns ON when the module status is being scanned by the CPU.

CARRIER DETECT – A Carrier Detect LED is ON when the Bus Controller is detecting a carrier signal on the FIP bus attached to that channel.

TRANSMIT ENABLE – A Transmit Enable LED is ON when the Bus Controller transmits data on the FIP bus attached to that channel. The intensity of this LED indicates the level of transmission activity in the bus. A dimly-lit Transmit Enable LED indicates low activity; a brightly-lit Transmit Enable LED indicates high activity.

Status Indications of the MODULE OK and RUN LEDs

Status	Meaning
MODULE OK on RUN on	The FBC module is correctly configured in the CPU.
MODULE OK on RUN off	The module does not exist in the CPU configuration, or The CPU configuration is incorrect, or Configuration by the HHP is under way.
MODULE OK on RUN blinking slowly	The FBC module is waiting for configuration or an external bus arbiter (either because they have not been sent, or because one or both are incorrect).
MODULE OK on RUN blinking rapidly	The FBC module is loading a configuration or an external bus arbiter.
MODULE OK blinking RUN off	Memory tests are under way.
MODULE OK and RUN blinking together	The firmware checksum is incorrect, or The firmware is being loaded.
MODULE OK and RUN blinking alternately	Fatal error: error in FULLFIP configuration or insufficient memory.

Upgrading the Bus Controller Firmware

To upgrade the Bus Controller firmware, connect the loading computer (PC) with the new firmware to the (15-pin) serial port on the front of the Bus Controller. From the loading PC, invoke the Loading Utility and follow its instructions to update the firmware.

Chapter 3 Hand-held Programmer Configuration

This chapter describes configuration steps for the Bus Controller using a Hand-held Programmer (HHP). The module must be physically present to be configured by the HHP. The HHP may be used to enter, change, or remove a configuration.

The Hand–Held Programmer must be connected to the power supply module and be connected to the PLC. The PLC power must be ON and the PLC in STOP mode. The FIP Bus Controller (FBC) must be installed in the desired slot.

Configuration of the FIP Bus Controller (FBC) includes choosing the Configuration mode and setting its parameters.

<table>
<tr><th>Mode 10</th><th>Mode 11</th></tr>
<tr><td colspan="2">FIP Bus Controller (FBC) slot number in the PLC rack</td></tr>
<tr><td>Configuration mode 10</td><td>Configuration mode 11</td></tr>
<tr><td colspan="2">Communication protocol (FIP / WorldFIP) and Tslot</td></tr>
<tr><td colspan="2">Subscriber number and medium number</td></tr>
<tr><td colspan="2">Maximum time between input scans by the CPU module</td></tr>
<tr><td>Not applicable</td><td>Bus arbiter (BA) version numbers and external configuration numbers</td></tr>
<tr><td>Addresses in %I PLC memory of 16 validity bits of consumed COMV's (1= invalid) and of the module status register.</td><td>Addresses in %I PLC memory of 16 validity bits of input areas (1=invalid) and of the module status register</td></tr>
<tr><td>Size and addresses in %R PLC memory of the input area (%RI), updated based on COMV's consumed by the module</td><td>Size and addresses in PLC memory of each of the 16 input areas, updated based on COMV's consumed by the module</td></tr>
<tr><td>Size and addresses in PLC memory %R of the output area (%RQ), used to build the COMV's produced by the module</td><td>Size and addresses in PLC memory of each of the 16 output areas, used to build the COMV's produced by the module</td></tr>
<tr><td>Not applicable</td><td>Configuration of COMV (9 maximum):
■ type of COMV (absent, produced or consumed),
■ COMV identifier,
■ refresh or promptness period associated with the COMV,
■ constitution of the COMV, including for each TVA (3 max):
□ type of TVA,
□ length of TVA,
□ position of TVA,
□ number of area containing TVA,
□ offset in area from which TVA is stored.</td></tr>
<tr><td>Not applicable</td><td>Configuration of COMV Statfbc:
■ presence of COMV (absent or produced),
■ COMV identifier,
■ refresh period associated with the COMV.</td></tr>
</table>

Configuration data is stored in the PLC. The configuration is static. It cannot be changed while the PLC is operating.

Setting the PLC to Stop Mode

If necessary, press the [RUN] key of the Hand–Held Programmer (HHP) to set the PLC to STOP mode.

```
PRESS<-/+>KEY<R
```

The **< R** characters in the top right indicate that the PLC is in RUN mode. Press the [–/+] key.

```
RUN MODE     <R
```

Press the [–/+] key again to change mode.

```
STOP MODE    <R
```

Press the [ENT] key. The HHP screen displays:

```
1. PROGRAM   <S
2. DATA
```

The **< S** characters in the top right indicate that the PLC is now in STOP mode.

FIP Bus Controller (FBC) Slot Number

In the Program / Data screen, select module configuration by pressing the [4] key, then the [ENT] key.

Press the [↓] key to call the configuration corresponding to the FIP Bus Controller (FBC) rack and **slot**.

- If the FIP Bus Controller (FBC) is already configured, it appears in the slot. For example:

```
R0:05 FBC    <S
I32:I0033–I0064
```

The top line indicates the baseplate (**R0**) and the slot (**:05**) selected. The bottom line shows the %I memory addresses attributed to the status bits.

When you press the [→] key, the Hand–Held Programmer (HHP) displays:

```
R0:05 FBC    <S
USING MODE:10
```

- If the module is present in the slot and the rack, without being configured, it does not appear on the screen. The HHP indicates that the slot is empty (**EMPTY**).

```
R0:05 EMPTY  <S
```

Press the [READ/VRFY] key, then the [ENT] key.

%I PLC Memory Addresses

Selection of **%I addresses** is the first operation to carry out. Just choose the location of the first %I and press [ENT].

In Configuration mode 10, the %I bits represent the COMV validity bits and the status bits. In Configuration mode 11, they represent the input area validity bits and the status bits.

Example:

The module is not yet part of the configuration stored by the PLC. It is inserted in slot 5. You wish to locate the %I bits as of %I1.

After switching to configuration mode and selecting the right location, press these keys:

Key Strokes	Display
	R0:05 EMPTY <S
[READ/VRFY] [ENT]	R0:05 FBC <S I32:I
[1] [ENT]	R0:05 FBC <S I32:I0001–0032

This example gives the following configuration:

- **for Configuration mode 10:**

  %I1 will be the validity bit of the first COMV defined in the COMV *config* (which only makes sense if the configured COMV is consumed), *%I2* will be the validity bit of the second COMV, etc.

  %I25 will be the bit indicating whether the network is active (0 = OK). *%I26* will be the bit indicating whether there is a redundancy fault (0 = OK).

- **for Configuration mode 11:**

  %I1 will be the validity bit of the first configured input area, *%I2* will be the validity bit of the second input area, etc.

  %I25 will be the bit indicating whether the network is active (0 = OK). %I26 will be the bit indicating whether there is a redundancy fault (0 = OK).

Configuration Mode

Press the [➡] key to be able to set the **Configuration mode** parameter.

The default **Configuration mode** is mode 10. If this mode has been selected, press the [➡] key to go directly to the next parameter.

To choose Configuration mode 11, press the [−/+] key to display the other Configuration modes. Then press the [ENT ↵] key to validate.

Example for mode 11:

Key Strokes	**Display**
[➡]	R0:05 FBC <S USING MODE : 10
[−/+] [ENT ↵]	R0:05 FBC <S USING MODE : 11

Note

The Configuration mode cannot be changed if any area (input or output) has been assigned. In this case, you must delete the assignments of each area, one by one, or else cancel the entire configuration (the [DEL] key), then start module configuration over again.

Communication Protocol and Tslot

To select the communication protocol, press the [➡] key. The default protocol is WorldFIP. If this is the protocol you want, press the [➡] key to go directly to the next parameter. Otherwise, press the [−/+] key to display the other protocols (FIP, slowFIP). Then press the [ENT] key to validate.

The next parameter is **Tslot**. Press the [➡] key. The default Tslot is 62 msec. If this is appropriate, press the [➡] key to go directly to the next parameter. Otherwise, press the [−/+] key to display the other values (250 msec, 625 msec, 2500 msec). Then press the [ENT] key to validate.

Note

The recommended value is **250 msec**; all other values are reserved for special requirements.

Example:

For a WorldFIP protocol, with a Tslot of 250 msec, proceed as follows:

Key Strokes	Display
[➡]	`R0:05 FBC    <S` `PROTOCOL : WORLD`
[➡]	`R0:05 FBC    <S` `TSLOT : 62`
[−/+] [ENT]	`R0:05 FBC    <S` `TSLOT : 250`

Subscriber Number and Medium Number

Press the [➡] key to select the **subscriber number**. Enter the subscriber number (between 0 and 255) and press [ENT] to validate.

The next parameter to select is the **medium number**. Press the [➡] key. By default, the network is simplex (single medium). If this is appropriate, press the [➡] key to go directly to the next parameter. Otherwise, press the [−/+] key to choose a redundant (dual medium) network, then [ENT] to validate.

Example:

Proceed as follows to choose FIP subscriber number “3” and a dual–medium architecture:

Key Strokes	**Display**
[➡]	R0:05 FBC <S SUBSCRIBER : 0
[3] [ENT]	R0:05 FBC <S SUBSCRIBER : 3
[➡]	R0:05 FBC <S MEDIUM : MONO
[−/+] [ENT]	R0:05 FBC <S MEDIUM : BI

Maximum Time Between Two CPU Module Input Scans

Press the [➡] key to select the **maximum cycle time**. Enter the time factor (between 1 and 255 times 100 msec) and press [ENT ↵] to validate.

Example:

For a FIP Bus Controller (FBC) associated with a CPU module that has a sweep time of less than 1 second, enter the following:

Key Strokes	Display
[➡]	R0:05 FBC <S MAX TIME : 1
[1] [0] [ENT ↵]	R0:05 FBC <S MAX TIME : 10

Bus Arbiter and External Configuration Version Numbers (Mode 11 Only)

Press the [→] key to select the **bus arbiter version number**. The default version number is “0”, which means the FBC module is not the bus arbiter; you can simply load the BA program through the serial port. If that is appropriate, press the [→] key to go directly to the next parameter. Otherwise, enter the version number (between 1 and 255) and press [ENT] to validate. In this case, you must load a bus arbiter program with the same version number as the number configured.

Example 1:

Proceed as follows to choose a FIP Bus Controller (FBC) which is a bus arbiter, with BA program number 3:

Key Strokes	Display
[→]	R0:05 FBC <S BA CONF : 0
[3] [ENT]	R0:05 FBC <S BA CONF : 3

The **external configuration version number** is the next parameter. Press the [→] key to select it. The default version number is ”0”. This means the network interface will be introduced by the HHP and you do not have to load the external configuration through the serial port. If this is appropriate, press the [→] key to go directly to the next parameter. Otherwise, enter the version number (between 1 and 255) and press [ENT] to validate. You will have to load an external configuration with the same version number as the number configured.

Example 2:

Proceed as follows to select an external configuration with version number 27:

Key Strokes	Display
[→]	R0:05 FBC <S EXT CONF : 0
[2] [7] [ENT]	R0:05 FBC <S EXT CONF : 27

Size and Addresses in the PLC Memory

Configuration mode 10

In Configuration mode 10, you must associate the input area (%RI) and the output area (%RQ) with the PLC memory.

Note

Although %R memory is recommended, other types are also permitted. Boolean variables must be a multiple of 16. In all cases, data is read and written in the COMV's as per the MSB / LSB method.

Input area (%RI)

Press the [➡] key to select the **variable type in input area**. Enter the variable type and press [ENT] to validate.

To select the **input area size**, enter the size of the area (0 to 127 words or else 0 to 2032 Boolean variables, representing 0 to 254 bytes), and press [ENT] to validate.

To select the **input area location**, enter the start address and press [ENT] to validate.

Example:

If you want 50 %RI addresses starting from the PLC address %R40, press these keys:

Key Strokes	Display
[➡]	R0:05 FBC IN1 <S UNASSIGNED
[R] [ENT]	R0:05 FBC IN1 <S R
[5] [0] [ENT]	R0:05 FBC IN1 <S R0050: R
[4] [0] [ENT]	R0:05 FBC IN1 <S R0050:R0040-0089

At each acquisition, the PLC will place the data consumed in the FIP network by the FIP Bus Controller (FBC) in the registers *%R40* to *%R89;* data will be distributed in these registers as per the configuration defined by the *config* COMV.

Output area (%RQ)

Press the [➡] key again to call the **output variable type** selection screen.

Proceed as for the input area.

Example:

If you want to have 32 %RQ addresses starting from the PLC address %R1, press these keys:

Key Strokes	Display
[➡]	R0:05 FBC OUT1 <S UNASSIGNED
[R] [ENT]	R0:05 FBC OUT1 <S R
[3] [2] [ENT]	R0:05 FBC OUT1 <S R0032: R
[1] [ENT]	R0:05 FBC OUT1 <S R0050:R0001–0032

At each output, the PLC will place the data produced on the FIP network by the FIP Bus Controller (FBC) in the registers *%R1* to *%R32;* the data is distributed in these registers as per the configuration defined in the *config* COMV.

Configuration mode 11

In Configuration mode 11, each input and output area must be associated with the PLC memory.

Input areas

Press the [➡] key to select the **variable type in each input area**. Enter the variable type and press [ENT] to validate. To select the **input area size**, enter the size of the area (0 to 2040 Boolean variables, representing 0 to 255 bytes, or else 0 to 127 words) and press [ENT] to validate. To select the **input area location**, enter the start address and press [ENT] to validate.

Example:

If you want to use 128 %I addresses, that is, 16 bytes, starting from address %I257 in the first input area (in 1), and 32 %AI addresses starting from address %AI97 in the second input area (in 2), proceed as follows:

First input area

Key Strokes	Display
➡	R0:05 FBC IN1 <S UNASSIGNED
I/AI ENT	R0:05 FBC IN1 <S I
1 2 8 ENT	R0:05 FBC IN1 <S I0128:I
2 5 7 ENT	R0:05 FBC IN1 <S I0128:I0257–0384

Second input area

Key Strokes	Display
➡	R0:05 FBC IN2 <S UNASSIGNED
I/AI I/AI ENT	R0:05 FBC IN2 <S AI
3 2 ENT	R0:05 FBC IN2 <S AI0032:AI
9 7 ENT	R0:05 FBC IN2 <S AI0032:AI0097–0128

At each acquisition, the PLC will place the Boolean inputs consumed in the FIP network by the FIP Bus Controller (FBC) at addresses *%I257* to *%I384*, and the analog inputs at address *%AI97* to *%AI128;* the data is distributed in these input areas as per the configuration defined by the network interface configuration.

Output areas

Press the ➡ key again to access selections for **output areas**. Proceed as for input areas, described above.

At each output, the PLC will place the data produced in the FIP network by the FIP Bus Controller (FBC) in the same way as for acquisitions.

Configuration of Each COMV (Mode 11 Only)

This operation is only possible if the network interface was configured with the Hand–Held Programmer (HHP) (external configuration version number = 0).

Press the [→] key to select the **COMV type**. The default COMV type is "empty" (no COMV). If this is appropriate, press the [→] key to go directly to the next COMV. Otherwise, press the [−/+] key to display the other COMV types (prod, cons), then [ENT] to validate.

Press the [→] key to select the next parameter, the **COMV identifier**. Enter the COMV number (between 0 and FFFF) and press [ENT] to validate.

Press the [→] key and enter the **COMV length** (between 1 and 125 bytes). Press [ENT] to validate.

Press the [→] key to select the next parameter, either the **refresh period** (if the COMV is produced) or the **promptness period** (if the COMV is consumed). Enter the factor of this period (between 1 and 65535 times 0.1 msec) and press [ENT] to validate.

For produced COMV's, press the [→] key to select the **COMV priority**. The default priority is "1" (top priority). If this is appropriate, press the [→] key to go directly to building the COMV. Otherwise, press the [−/+] key to display the other priorities ("2", "3", "4") and [ENT] to validate.

The next step in configuration is the building of the COMV defined as described above.

Example:

Proceed as follows to configure a produced COMV with identifier 80A5 (hexadecimal), length 48 bytes, refresh period 250 msec and top priority (1).

Key Strokes	Display
[➡]	R0:05 FBC <S COMV 1: EMPTY
[−/+] [ENT]	R0:05 FBC <S COMV 1: PROD
[➡]	R0:05 FBC <S COMV 1 ID: 0000H
[8] [0] [I/AI] [5] [ENT]	R0:05 FBC <S COMV 1 ID: 80A5H
[➡]	R0:05 FBC <S COMV 1 LEN: 1
[4] [8] [ENT]	R0:05 FBC <S COMV 1 LEN: 48
[➡]	R0:05 FBC <S COMV 1 PER: 0
[2] [5] [0] [0] [ENT]	R0:05 FBC <S COMV 1 PER: 2500
[➡]	R0:05 FBC <S COMV 1 PRIOR: 1

Building each COMV (Mode 11 Only)

This operation is only possible if the network interface was configured with the Hand–Held Programmer (HHP) (external configuration number = 0).

Press the [➡] key to configure the first TVA of the first COMV (“C1T1”), the first time it is pressed, or the next TVA for the current COMV thereafter.

The first parameter is the **TVA type**:

> “empty” (no TVA) is the default type. If this is appropriate, press the [➡] key to go directly to the next TVA of the same COMV (”C1T2”). Otherwise, press the [−/+] key to display the other types:

- “bool off”: Boolean variable with value ”0” (TVA at 0) in the case of a consumed COMV reception fault,
- “bool frz”: Boolean variable whose value is frozen (TVA frozen) in the case of a consumed COMV reception fault,
- “num off”: numerical variable (words coded as per FIP standard, from MSB to LSB), with value ”0” (TVA at 0) in the case of a consumed COMV reception fault,
- “num frz”: numerical variable (words coded as per FIP standard, from MSB to LSB) in the case of a consumed COMV reception fault.

After selecting the TVA type, press [ENT] to validate. Then press the [➡] key to go to the next parameter, TVA length (“len”).

Enter the length (1 to 125 bytes for Boolean variables, or else an even value between 2 and 124 bytes for numerical variables). Press [ENT] to validate.

Press the [➡] key to select **TVA position in COMV**. Enter the **position**(“pos”) (between 0 and 124 bytes), then press [ENT] to validate.

Press the [➡] key to go to the next parameter (“area”), selection of the **input area** (for a consumed COMV) or the **output area** (for a produced COMV). Enter the **area number** (between 1 and 16) and press [ENT] to validate.

Press the [➡] key to select **TVA position in the area** (offset). Enter the **offset**(”off”) (between 0 and 254 bytes for Boolean variables, or an even value between 0 and 252 bytes for numerical variables). Press [ENT] to validate.

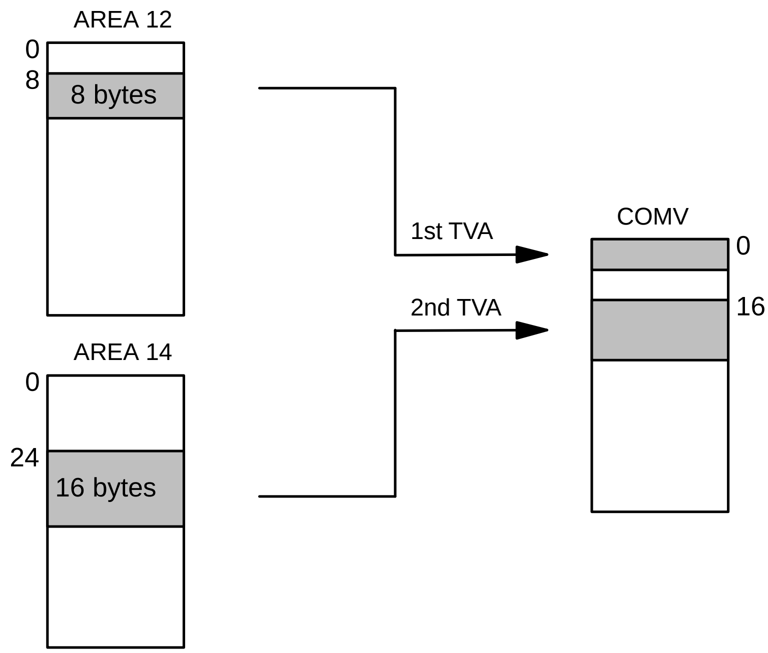
Building a COMV (mode 11 only)

The next step in configuration is definition of the next TVA for the current COMV; or, when all TVA's of the current COMV have been defined, definition of the next COMV (COMV type, etc.); or, when all COMV's have been defined, by definition of the *Statfbc* COMV.

Example:

To complete the configuration steps of produced COMV as described above, and have the following results:

- 1st TVA: 8 Boolean bytes from area 12 (starting with offset 8) will be stored at COMV position 0,
- 2nd TVA: 16 numerical bytes from area 14 (starting with offset 24) will be stored at COMV position 16.



For these results, proceed as follows:

Configuration of 1st TVA

➡	R0:05 FBC <S C1 T1: EMPTY
−/+ ENT	R0:05 FBC <S C1 T1: BOOL OFF
➡	R0:05 FBC <S C1 T1 LEN: 1
8 ENT	R0:05 FBC <S C1 T1 LEN: 8
➡	R0:05 FBC <S C1 T1 POS: 0
➡	R0:05 FBC <S C1 T1 AREA: 1
1 2 ENT	R0:05 FBC <S C1 T1: AREA: 12
➡	R0:05 FBC <S C1 T1 OFF: 0
8 ENT	R0:05 FBC <S C1 T1 OFF: 8

Configuration of 2nd TVA

Keys	Display
→	R0:05 FBC <S C1 T2: EMPTY
−/+ −/+ −/+ ENT	R0:05 FBC <S C1 T2: NUM OFF
→	R0:05 FBC <S C1 T2 LEN: 1
1 6 ENT	R0:05 FBC <S C1 T2 LEN: 16
→	R0:05 FBC <S C1 T2 POS: 0
1 6 ENT	R0:05 FBC <S C1 T2 POS: 16
→	R0:05 FBC <S C1 T2 AREA: 1
1 4 ENT	R0:05 FBC <S C1 T2 AREA: 14
→	R0:05 FBC <S C1 T2 OFF: 0
2 4 ENT	R0:05 FBC <S C1 T2 OFF: 24

Configuration of the STATFBC COMV (Mode 11 Only)

This operation is only possible if the network interface was configured with the Hand–Held Programmer (HHP) (external configuration version number = 0).

Press the [➡] key to select the ***Statfbc* COMV**. The default selection is "no" (COMV not produced). If this is appropriate, configuration is over. Otherwise, press the [−/+] key to display "yes". Then press [ENT] to validate.

Press the [➡] key to select the **identifier**. Enter the number of the *Statfbc* COMV (0 to FFFF) and press [ENT] to validate.

Press the [➡] key to select the next parameter, the **refresh period** ("refr" = refresh). Enter the factor for the period (1 to 65535 times 0.1 msec) and press [ENT] to validate.

Example:

To configure the produced *Statfbc* COMV with identifier 0030 (hexadecimal) and refresh period 500 msec:

Key Strokes	Display
[➡]	R0:05 FBC <S STATFBC PROD: NO
[−/+] [ENT]	R0:05 FBC <S STATFBC PROD: YES
[➡]	R0:05 FBC <S STATFBC ID: 0000H
[0] [0] [3] [0] [ENT]	R0:05 FBC <S STATFBC ID: 0030H
[➡]	R0:05 FBC <S STATFBC REFR: 0
[5] [0] [0] [0] [ENT]	R0:05 FBC <S STATFBC REFR: 5000

Validation of Configuration

Note

The module must be reconfigured <u>every time</u> the PLC is reconfigured.

To validate the HHP configuration, display the Configuration mode: press the [−/+] key to display the "GO" message and press [ENT] to validate. The "GO" message flashes during configuration, then the selected Configuration mode (mode 10 or mode 11) is displayed.

Example:

- Mode 10:

Key Strokes [−/+] [−/+] [ENT]

Display

```
R0:05 FBC    <S
USING MODE: 10
```

```
R0:05 FBC    <S
USING MODE: GO
```

```
R0:05 FBC    <S
USING MODE: 10
```

- Mode 11:

Key Strokes [−/+] [ENT]

Display

```
R0:05 FBC    <S
USING MODE: 11
```

```
R0:05 FBC    <S
USING MODE: GO
```

```
R0:05 FBC    <S
USING MODE: 11
```

Hand-held Programmer (HHP) Error Messages

The Hand–Held Programmer (HHP) displays error messages to inform you of configuration errors, if the FIP Bus Controller (FBC) is absent, or if it is not communicating with the PLC.

Message	Meaning
REFER	The reference address is outside the range of this PLC model.
REFADJ	Indicates one of the following situations: A. References have been adjusted to the lowest byte. B. Logical references have been adjusted to the highest byte.
I/OERR	You have assigned reference addresses which overlap with references already assigned.
DATERR	A parameter is outside permissible limits.
CFGERR	Configuration error.

Chapter 4

Configuration and Operating Modes

This chapter describes the characteristics of Configuration modes 10 and 11.

- Configuration Mode 10
  - Control of Network Interface Operating Modes
  - Exchange of Application Data Between the CPU and the Network (Mode 10)
  - Characteristics and Performance of Mode 10
- Configuration Mode 11
  - Control of Network Interface Operating Modes
  - Application Data Exchange between the CPU and Network (Mode 11)
  - Control of Bus Arbiter
  - Characteristics and Performance

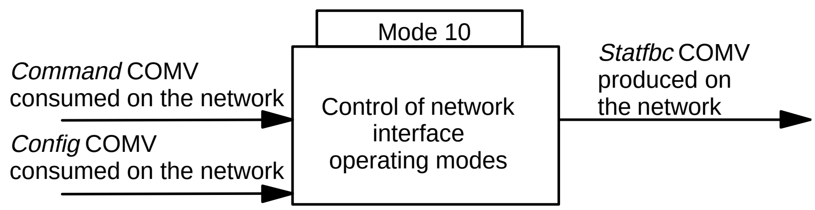
Appendix B gives two examples common to Configuration modes 10 and 11.

Configuration Mode 10

Control of Network Interface Operating Modes

In Mode 10, the FIP Bus Controller (FBC) is a slave module. The operating modes of its network interface are linked to the contents of the *Command* and *Config* COMVs consumed by the Bus Controller on the FIP network.

The FBC software periodically produces the *Statfbc* COMV, which indicates to the other devices the current operating mode of its network interface.



Command COMV

In Mode 10, the *Command* COMV is received periodically by the network. Its transmitter must only refresh its contents when the current network interface operating mode is changed. That is the only time the command is acknowledged by the FBC software. The FIP identifier of the *Command* COMV is:

0100 (hexadecimal) + subscriber number

The *Command* COMV contains two bytes specific to it, plus a refresh byte.

See Appendix A for further information.

Config COMV

The FIP identifier of the *Config* COMV is:

0200 (hexadecimal) + subscriber number

The *Config* COMV contains 124 bytes specific to it, plus a refresh byte.

See Appendix A for further information.

Statfbc COMV

The *Statfbc* COMV is periodically transmitted by the FBC software, when it has received and acknowledged the configuration provided by the PLC. The FIP identifier of the *Statfbc* COMV is:

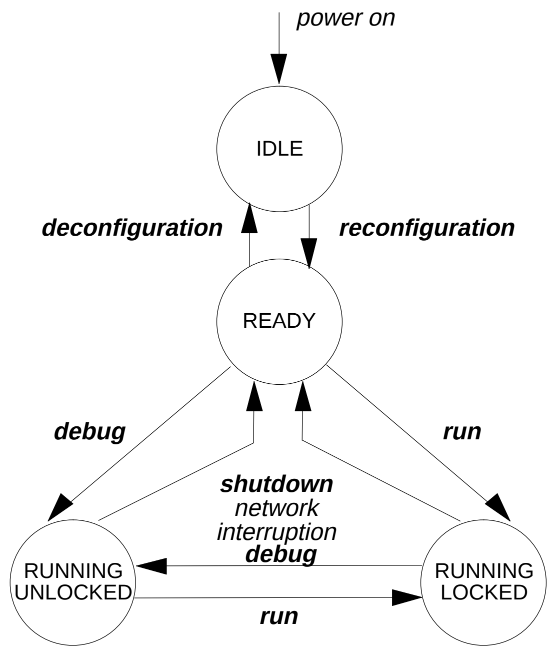
0000 (hexadecimal) + subscriber number

The *Statfbc* COMV contains 8 bytes which are specific to it, plus a refresh byte.

See Appendix A for further information.

FIP Bus Controller (FBC) Network Interface Operating Modes in Mode 10

The following diagram shows changes in the FIP Bus Controller (FBC) network interface operating modes in Configuration mode 10:



The FBC network interface operating modes are:

idle :

The FBC is in *idle* mode after power is applied and it has received the configuration from the PLC, or after it has received a configuration change (command received in *ready* mode).

In this mode, only the *Statfbc* COMV is transmitted. The only COMVs consumed are the *Command* COMV and, if necessary, the *Config* COMV.

ready :

The FBC is in *ready* mode after it has received a configuration command via the *Command* COMV, and has consumed the *Config* COMV (containing valid information). The module automatically adopts this mode when network service is interrupted or the bus arbiter shut down while the operating mode was *running–lock ed* or *running–unlock ed*.

running–lock ed :

The FBC is in the *running–lock ed* mode after it has received a start–up command via the *Command* COMV.

If network service is interrupted or the bus arbiter shut down while in this mode, the FBC automatically goes to *ready* mode.

running–unlock ed :

The FBC is in *running–unlock ed* mode after it receives a debug command via the *Command* COMV.

If network service is interrupted or the bus arbiter shut down while in this mode, the FBC automatically goes to *ready* mode.

Implementation (for Mode 10)

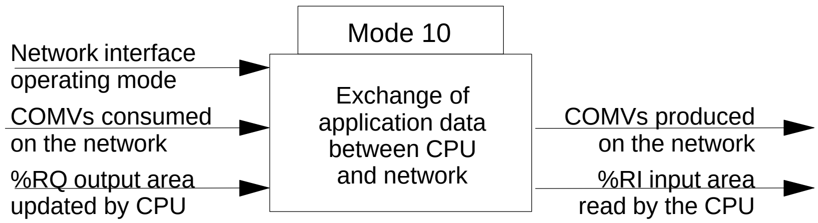
The *Config* COMV indicates to the module which COMVs it must produce or consume. This COMV is only read and acknowledged when it has received a configuration order via the *Command* COMV, while the current Configuration mode is *idle*. It is therefore pointless to refresh the Config COMV in other cases.

Proceed as follows to be sure the *Config* and *Command* COMVs are correctly refreshed when there is a configuration command:

- Build the *Config* and *Command* COMVs: the *Command* COMV contains a configuration order (both bytes equal 0).
- Refresh the *Config* COMV.
- Wait until the *Config* COMV identifier has passed.
- Refresh the *Command* COMV.
- Refresh the *Config* COMV.
- If, after a period of time equal to 200 msec + the *Statfbc* COMV period, the operating mode indicated in this COMV is not *ready*, then the configuration is wrong (it is assumed that the module's operating mode was *idle*, that network service was not interrupted, etc.).

Exchange of Application Data Between the CPU and the Network (Mode 10)

Exchange of application data between the CPU and the network is completely dependent on the network interface operating mode.



Exchange of application data

The following operations are executed for application data depending on the network interface operating mode:

idle:

In this mode, only the *Statfbc* COMV is sent; only the *Command* COMV and, if necessary, the *Config* COMV, are consumed. Application COMVs are neither sent nor received.

The entire *%RI* input area (or other type) is initialized to 0 and the 16 *%I* validity bits are initialized to 1.

ready:

In this mode, the COMVs produced are built from the *%RQ* output area (or other type), when the application is active. If the application stops, the COMVs produced are no longer refreshed (for the consumers of these COMVs, the FIP *status* bytes will become invalid).

In this mode, the COMVs configured to be consumed by the device are not read, and the validity bits corresponding to these COMVs are set to 1. The others are set to 0.

Furthermore:

- when the module is in this operating mode, following a configuration or shutdown command, the *%RI* input area (or other type) used to store the data from the FIP bus is set to 0.
- when this operating mode is due to an interruption of network service or bus arbiter shutdown, the *%RI* input area is either set to 0 or frozen (no value change), depending on the configuration received in the *Config* COMV.

running–lock ed:

In this mode, the COMVs produced are built from the *%RQ* output area (or other type), when the application is active. If the application is stopped, the COMVs produced are no longer refreshed (for consumers of these COMVs, the FIP *status* bytes will become invalid).

In this mode, the COMVs configured to be consumed by the device are read: each time a valid COMV is read, the corresponding *%RI* input area (or other type) is updated based on the contents of the COMV and its configuration as well as the corresponding *%I* validity bit (set to 0). Each time an invalid COMV is read, the corresponding *%RI* input area is frozen or set to 0, depending on its configuration as well as the corresponding *%I* validity bit (set to 1). The *%I* validity bits which do not correspond to consumed COMVs are set to 0.

Dialog occurs cyclically as follows:

The following operations are executed, in order of decreasing priority:

1. dialog with the CPU module,
2. read of COMVs as of reception,
3. write of COMVs depending on their frequency.

In addition, the FBC module tests the media, with a frequency less than the shortest refresh and promptness period.

running–unlock ed:

COMVs are produced and consumed similarly to the *running–lock ed* operating mode, except that when an invalid COMV is read, the corresponding *%RI* input area has to be frozen.

Characteristics and Performance of Mode 10

The main characteristics of Configuration mode 10 are as follows:

- The FIP configuration is as follows:
  - number of media: 1 or 2
  - transmit rate: 1 Mbit / sec
  - Tslot: configurable to 62 msec, 250 msec, 625 msec, 2500 msec
  - return time: 42 msec (slowFIP),10 msec (FIP / WorldFIP)
  - silence time–out: 240 msec (slowFIP),100 msec (FIP / WorldFIP)
  - physical layer protocol: *slowFIP*, *FIP* (*NFC*), WorldFIP (*IEC*)

  All produced COMVs contain the FIP *status* byte which indicates refreshment. All consumed COMVs must be sent by their producer with the FIP *status* byte containing the refreshment indication.

- Maximum time between passage of the *Command* COMV identifier (different from a configuration order), which changes the operating mode, and refreshment of the *Statfbc* COMV, which indicates the new mode: 20 msec.
- Maximum time between passage of the *Command* COMV containing a configuration order, and refreshment of the *Statfbc* COMV after passing to the *ready* operating mode: 200 msec.
- Total number of application COMVs: 1 to 12
- Number of application COMVs consumed: 0 to 12
- Number of application COMVs produced: 0 to 12
- Number of *%R* exchanges between the FBC and the C80–35 PLC: 0 to 127, in each direction
- Number of *%R* transported in an application COMV: 0 to 62
- Duration of elementary operations:
  - read of consumed COMV: < 1 msec
  - write of produced COMV (including *Statfbc*): < 1 msec
  - detection of loss of medium: < 3 msec
- dynamic characteristics of interface with the CPU:
  - access time to module (read command + write command per PLC sweep, application data transfer time not included):

    v 5 msec + *exchange_time* + *time_if_error*

  exchange_time =1 msec * *n_bytes* (= total number of bytes exchanged with the CPU module)

  time_if_error = 10 msec * *n_TVA*. This only occurs if there is a loss of medium (*n_TVA* = total number of TVAs making up consumed COMVs) or a refresh error of a consumed COMV (*n_TVA* = number of TVA making up the COMV in question).

  - transmit rate of I / O buses used in dialog with the CPU:

    CPU 331: 23 msec per word

CPU 341: 20 msec per word

CPU 351: 18 msec per word

- dynamic characteristics of the network interface:
  - acknowledgment time of an avalanche of *N* consumed COMVs (*N* COMVs transmitted successively at network maximum speed):

    v 3 msec + (1 msec * *N*) + *exchange_time* + *time_if_error*
    (it is assumed that there is no more than one PLC sweep during the avalanche)

  - maximum time to refresh a COMV after writing by the CPU: depends on the priority *P* attributed during configuration (a COMV is sent every *P* internal sweeps); the maximum sweep time is:

    5 msec + 1 msec * *n_COMV* + *exchange_time* + *time_if_error*

  where *n_COMV* is the total number of COMVs consumed and produced during this sweep (+1 if the configuration requests production of the *Statfbc* COMV); one assumes there has been at most one exchange with the CPU during the sweep.

It should be noted that the FBC module automatically generates, internally, the priority of produced COMVs, in order to determine the configuration transmission frequency.

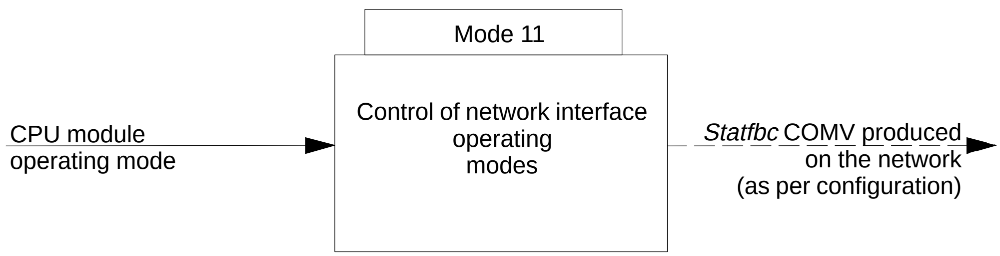
Appendix B includes two examples common to Configuration modes 10 and 11.

Configuration Mode 11

Control of Network Interface Operating Modes

In Mode 11, the FIP Bus Controller (FBC) is a self–governing module. The operating modes of its network interface are automatically controlled by the FBC module itself. They also depend on the configuration the FBC has received from the PLC after initialization.

If the configuration so specifies, the *Statfbc* COMV is produced periodically. This indicates the current network operating mode to the other devices.



Operating Mode

Once configured, the FBC module adopts its operating mode, as per the CPU module.

Statfbc COMV

If the configuration requires it, the *Statfbc* COMV is sent periodically by the FBC software, when it has received and acknowledged the configuration provided by the PLC.

The FIP identifier of the *Statfbc* COMV is configurable (as is the refresh period).

The *Statfbc* COMV contains 8 bytes which are specific to it, plus a byte indicating refreshment.

See Appendix A for further information.

FIP Bus Controller (FBC) Network Interface Operating Modes (Mode 11)

The FBC has the following network interface operating modes:

- *idle*:

  The FBC is in this mode after power is applied, as soon as the internal initializations are complete, but the configuration (generated by the Hand–Held Programmer or the programmer), the bus arbiter and the external configuration have not yet been installed. The module returns to this state after a new configuration received in *ready* mode.

  In this mode, no COMVs are produced or consumed.

- *ready*:

  The FBC is in this mode once the configuration generated by the HHP or the programmer, the bus arbiter, and the external configuration have been installed. The module remains in or returns to this state until the CPU module has run a scan (STOP state).

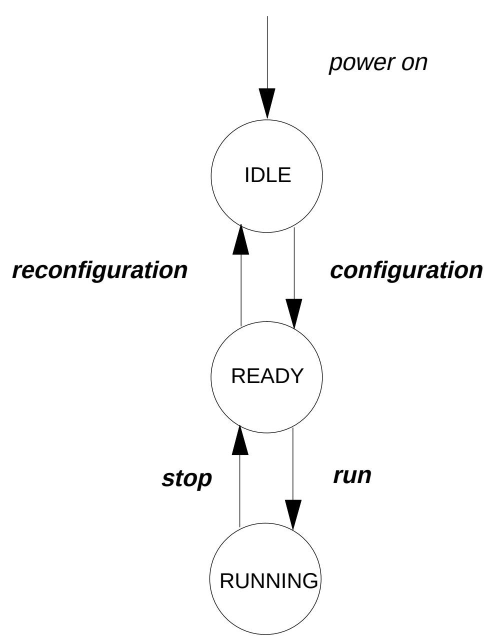
  In this mode, if the configuration requests it, the *Statfbc* COMV is produced.

- *running:*

  The FBC is in this mode while the CPU is scanning (RUN state).

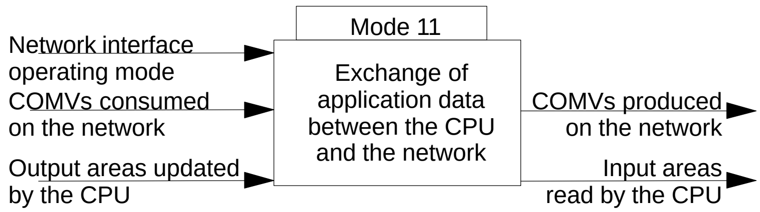
  In this mode, if the configuration requires, the *Statfbc* COMV is produced.

The following figure shows the changes in network interface operating modes (running mode 11):



Application Data Exchange between the CPU and Network (Mode 11)

The exchange of application data between the CPU and the network depends entirely on the network interface operating mode.



Data Exchange

Depending on the operating mode, the following operations are run on application data:

idle:

No application COMV is either produced or consumed.

ready:

No application COMV is refreshed.

The application COMVs configured to be consumed by the device are processed in the same way as in *running* mode.

running:

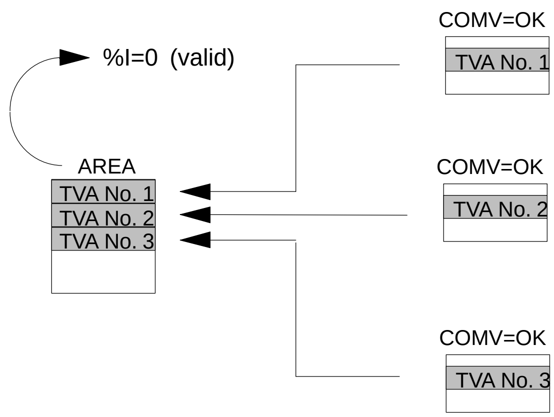
The application COMVs produced are representative of output data, updated by the CPU module.

The application COMVs configured to be consumed by the device are read by the FBC module. Rank "*n*" associated with each *%I* validity bit corresponds to the rank of each input area.

The *%I* validity bits associated with unused areas are set to 0.

A *%I* validity bit is declared valid when all input data (TVAs) making up the associated input area is valid: that is, when the *status* bits (refresh and promptness) associated with the COMVs that own these TVAs are valid. In this case, the input data is provided for the CPU in the input areas.

%I validity bits



A *%I* validity bit is declared invalid whenever one of the input data items (TVA) making up the associated input area is invalid: that is, when the *status* bits (refresh or promptness) associated with the COMV which owns the TVA are invalid. In this case, the input area including this data is provided for the CPU with the configured fall–back values (0 or frozen).

Dialog occurs cyclically as follows:

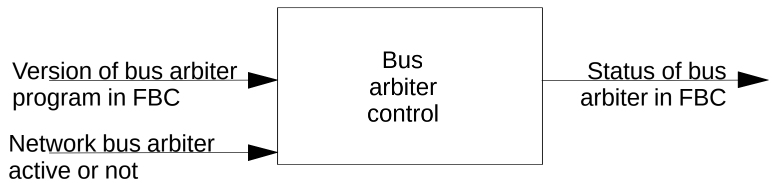
The following operations are executed, in order of decreasing priority:

1. dialog with the CPU module,
2. read of COMVs as of reception,
3. write of COMVs depending on their priority level (1 to 4).

In addition, the FBC module tests the media, with a frequency less than the shortest refresh and promptness period.

Control of Bus Arbiter

The FBC module may be the bus arbiter, depending on whether or not it has a version of the bus arbiter and whether or not the network bus arbiter is active.



Bus Arbiter Control

The bus arbiter has the following operating modes:

Init:

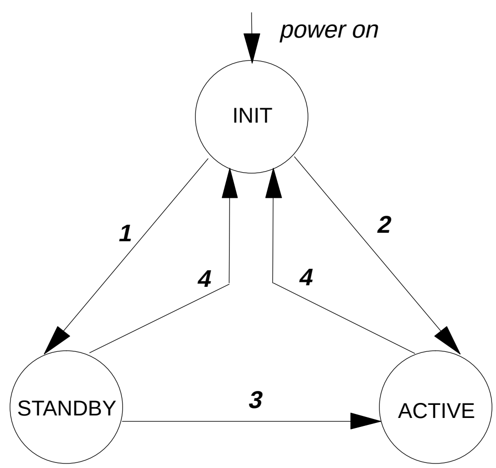
The FBC module has <u>no</u> bus arbiter whose version number corresponds to the "*BA conf*" parameter. The bus arbiter is absent or unusable.

Standby:

The FBC module has a bus arbiter whose version number corresponds to the "*BA conf*" parameter. The bus arbiter is ready and waiting to be chosen.

Active:

The FBC module has a bus arbiter whose version number corresponds to the "*BA conf*" parameter. The bus arbiter is active.



Transitions between operating modes are:

1. A bus arbiter has just been loaded with a correct version number, but another bus arbiter is active.
2. A bus arbiter has just been loaded with a correct version number, and no other bus arbiter is active.
3. The FBC module detects that the previous bus arbiter has stopped, and therefore activates its bus arbiter.
4. A new bus arbiter or a new configuration is being loaded.

Characteristics and Performance

Configuration mode 11 has the following main characteristics and performance:

- The FIP configuration is as follows:
  - number of media: 1 or 2
  - transmit rate: 1 Mbit / sec
  - Tslot: configurable to 62 ms, 250 ms, 625 ms, 2500 ms
  - return time: 42 msec (slowFIP), 10 msec (FIP / WorldFIP)
  - silence time–out: 240 msec (slowFIP), 100 msec (FIP / WorldFIP)
  - physical layer protocol: *slowFIP*, *FIP* (*NFC*), WorldFIP (*IEC*)

  All produced COMVs contain the FIP *status* byte which indicates refreshment. All consumed COMVs must be sent by their producer with the FIP *status* byte containing the refresh indication.

- Total number of application COMVs: 1 to 32 (1 to 9 if configured by the HHP).
- Total number of TVAs per application COMV: 1 to 125 (1 to 3 if configured by the HHP).
- Total number of TVAs: 1 to 1000.
- Maximum size of data exchanged between the FBC module and the PLC:
  - 16 input areas each containing 1 to 255 bytes,
  - 16 output areas each containing 1 to 255 bytes.
- Duration of elementary operations:
  - read of a consumed COMV: < 1 msec
  - write of a produced COMV (including *Statfbc*): < 1 msec
  - detection of loss of a medium: < 3 msec
- dynamic characteristics of CPU interface:
  - module access time (read command + write command by PLC sweep, not including application data transfer time):

    v 5 msec + *exchange_time* + *time_if_error*

    exchange_time =1 msec * *n_bytes* (= total number of bytes exchanged with CPU module)

    time_if_error = 10 msec * *n_TVA*. This time is only involved when a medium is lost (*n_TVA* = total number of TVAs making up the consumed COMVs) or when there is a refresh error of a consumed COMV (*n_TVA* = number of TVAs making up the COMV concerned).
  - transmit rate of I / O bus used during dialog with the CPU:

CPU 331:	23 msec per word
CPU 341:	20 msec per word
CPU 351:	18 msec per word

- dynamic characteristics of network interface:

- time for acknowledgment of an avalanche of *N* consumed COMVs (*N* COMVs transmitted successively at maximum network speed):

  v 3 msec + (1 msec * *N*) + *exchange_time* + *time_if_error*
  (assuming there is no more than one PLC sweep during the avalanche)

- maximum time to refresh a COMV after write by the CPU: depends on priority level *P* attributed during configuration (a COMV is transmitted every *P* internal sweeps); the maximum duration of a sweep is:

  5 msec + 1 msec * *n_COMV* + *exchange_time* + *time_if_error*

  where *n_COMV* is the total number of COMVs consumed and produced during the sweep (+ 1 if the configuration requires production of the *Statfbc* COMV); it is assumed that there is at least one exchange with the CPU during the sweep.

Chapter 5 Configuration and Operating Modes

Diagnostics concerning the network are made possible by the contents of the *Statfbc* COMV (see Appendix A). Updating of this variable is part of control of network interface operating modes (Configuration mode 10 or 11), and of exchange of application data between the CPU and the network (Configuration mode 10 only).

Diagnostics concerning the CPU are made possible by the status of the following input bits:

Address	Meaning	Context
%I1 to %I16	Input area validity bits	Exchange of application data between CPU and network (Configuration mode 11 only)
%I17	Bus arbiter (BA) active if %I17 is set to "1".	Control of bus arbiter (Configuration mode 11 only)
%I25	Network active if %I25 is set to "0".	Control of network interface operating modes (Configuration modes 10 and 11).
%I26	No redundancy error if %I26 is set to "0".	Control of network interface operating modes (Configuration modes 10 and 11)

Appendix A — Description of COMVs

This appendix contains detailed description of the COMVs used in the various functions of the FIP Bus Controller (FBC).

Command COMV

The *Command* COMV (Configuration mode 10 only) contains the transition necessary for changing operating modes (idle, ready, running–locked or running–unlocked).

The FIP identifier of the *Command* COMV is:

0100 (hexadecimal) + subscriber number

The *Command* COMV contains two bytes specific to it (described below), plus a refresh byte.

- 1st byte: coded command (hexadecimal)

00	configuration
01	deconfiguration
02	run (Running–locked)
03	stop
04	adjust (Running–unlocked)

- 2nd byte: reserved (contains 0).

Config COMV

The FIP identifier of the *Config* COMV is:

0200 (hexadecimal) + subscriber number

The *Config* COMV (using mode 10 only) contains 124 bytes specific to it (described below), plus a refresh byte.

Word	Description
1	Configuration version number (1 to FFFF in hexadecimal). This number is placed in the *Statfbc* COMV.
2	Reserved
3	Refresh frequency of the *Statfbc* COMV (factor of 0 to FFFF in hexadecimal, times 0.1 msec).
4	Reserved
5	Promptness frequency of the *Command* COMV (factor of 0 to FFFF in hexadecimal, times 0.1 msec).
6	Reserved
7	Promptness frequency of the *Config* COMV (factor of 0 to FFFF in hexadecimal, times 0.1 msec).
8 to 19 (6 groups of 2 words)	Frequency of application COMVs each group contains: 1st word: transmission frequency if the COMV is produced (factor of 0 to FFFF in hexadecimal, times 0.1 msec), 2nd word: refresh frequency if the COMV is produce, or promptness frequency if the COMV is consumed (factor of 0 to FFFF in hexadecimal, times 0.1 msec).
20 to 61 (12 groups of 7 bytes)	Configuration of application COMVs. Each group contains the following: The 1st byte includes 3 parameters: ■ bits 0 to 2: type of TVA: 000 no TVA 011 %RI – the COMV is produced, therefore the TVA contains the input registers 110 %RQ – the COMV is consumed, therefore the TVA contains the output registers Other values are non–representative ■ bit 3: default mode of TVA inputs when the *status* bits of the consumed COMVs are invalid: 0 reset 1 frozen at last valid status ■ bits 4 to 7: rank of frequency: 0000 rank 0 0001 rank 1 0010 rank 2 0011 rank 3 0100 rank 4 0101 rank 5
	The 2nd byte indicates the position in the COMV (0 to 122 bytes) where the TVA is written (for a consumed COMV) or read (for a produced COMV).
	Byte 3 indicates the offset in the data area where the TVA is written (for input data) or read (for output data). This is expressed as a number of bytes (0 to 254).
	The 4th byte indicates the length of the TVA (0 to 124 bytes). This must be an even number. If it is zero, the TVA does not exist.
	The 5th byte contains the length of the COMV (0 to 124 bytes, not including the refresh bit). If this byte is 0, the COMV does not exist.
	Bytes 6 and 7 contain the identifier of the associated COMV (0 to FFFF hex).
62	checksum of the first 122 bytes of the COMV (0 to FFFF in hexadecimal).

Statfbc COMV

The *Statfbc* COMV is transmitted periodically by the FBC software (always, in running mode 10; only if the configuration specifies, in running mode 11).

The FIP identifier of the *Statfbc* COMV is:

0000 (hexadecimal) + subscriber number

The *Statfbc* COMV contains 8 bytes specific to it (described below), plus a refresh byte.

Word	Description
1	Type 1 subscriber (=03 in hexadecimal). This parameter indicates that the subscriber is a Series 90-30 or an Alspa C80–35PLC.
2	Type 2 subscriber. This parameter contains the Configuration mode (10 or 11) in hexadecimal.
3, 4	Version number of: ■ the network interface configuration, indicated in the first two bytes of the *Config* COMV (for mode 10), ■ the external configuration (for mode 11). Version number 0 means there is no configuration. The configuration number is between 1 and FFFF (hexadecimal).
5	Operating mode of the FIP Bus Controller (FBC) network interface (hex). In Configuration mode 10: 00 error 01 idle 02 ready 03 running–locked 04 running–unlocked In Configuration mode 11: 00 error, 02 ready 03 running
6	Contains the following bits: ■ bit 0: FIP *status* bit. This parameter is set to 1 as soon as a consumed COMV becomes invalid (invalid refresh or promptness). ■ bits 1 to 6: reserved ■ bit 7: in using mode 10, indicates the ”standby” status; it is set to 1 as soon as the network is disconnected and reset by a *Command* COMV. Not used in mode 11.
7	Contains the following bits: ■ bit 0: host *status* This parameter is set to 1 as soon as the FBC detects a CPU communicationfault. ■ bit 1: applicationrunning This parameter is set to 1 as soon as the application stops running. ■ bit 2: redundantmedia This bit is set to 1 as soon as one of the two media is disconnected, when redundancy has been selected. ■ bits 3 to 7: not applicable
8	Reserved for software version (0 to FF in hexadecimal).

Appendix B *Examples*

The two examples below are common to Configuration modes 10 and 11.

Example 1

In this example, not much data is exchanged between the FBC module and the CPU. This means dialog over the FIP bus is fast. The configuration is as follows:

- 2 consumed COMVs of 4 bytes, each including a 4–byte TVA.
- 2 produced COMVs of 4 bytes, at priority 1 (highest possible rate), each with a 4–byte TVA, plus the *Statfbc* COMV.
- The refresh and promptness frequencies of the COMVs are each 10 msec. The network validity must be tested in the worst case every 10 msec.
- The bus arbiter program provides transport of the 5 COMVs alone, at the highest rate (no *BA_WAIT*) over the FIP bus.
- The FBC and the CPU module exchange 32 bytes in each direction, plus the 32 validity bits (68 bytes in all).
- The application program, defined for a 331 CPU, is minimum: it only copies the 8 bytes consumed on the FIP bus in the 8 bytes produced.

Under these conditions, a measurement made over 100 seconds shows the following characteristics:

- 91650 internal sweeps (producing, each time, the 2 COMVs + *Statfbc*); an application COMV is therefore produced on average every 550 msec.
- 146232 COMV reads; a COMV is therefore consumed on average every 700 msec.
- The FBC module has processed on average over 4200 COMVs per second.
- The average application sweep time (all sweep components included) is 10 msec.
- The average module access time is 2 msec.

Example 2

In this example, a very large amount of data is exchanged between the FBC and the CPU over the FIP bus. The configuration is as follows:

- 16 consumed COMVs of 125 bytes, each including 31 2–byte TVAs (the format selected is numerical, implying return of bytes).
- 16 produced COMVs of 125 priority–1 bytes (highest possible rate), each including 31 2–byte TVAs (in numerical format), plus the *Statfbc* COMV.
- The total is 992 TVAs.
- The refresh and promptness frequencies of the COMVs are each 100 msec. Network validity must be tested in the worst case every 100 msec.
- The bus arbiter program provides transport of the 33 COMVs only, at maximum rate (no *BA_WAIT*) over the FIP bus.
- The FBC module and the CPU exchange 2 Kbytes in each direction.
- The application program, defined for a 331 CPU, is the same as previously. In this environment, the PLC sweep time is approximately 70 msec. For the experiment to be conclusive, the sweep time is forced to 100 msec (i.e., only 30 msec is considered enough time to process the 4 Kbytes exchanged between the FBC module and the CPU).

Under these conditions, a measurement over 100 seconds shows the following characteristics:

- 5295 internal sweeps (each producing the 16 COMVs + *Statfbc*); an application COMV is therefore produced on average every 1.2 msec.
- 41345 COMV reads. A COMV is therefore consumed on average every 2.4 msec.
- The FBC module therefore processed over 1300 COMVs per second.
- The average module access time is 2 msec.

A

B

C

D

E

F

G

H

I

L

M