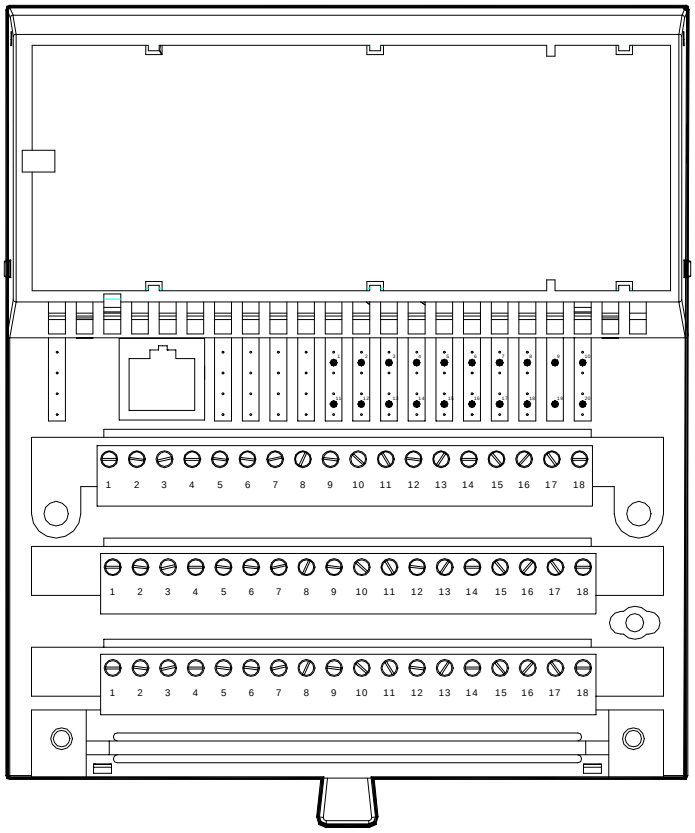
Integrated Industrial Technologies, Inc.
Innovative Ideas in Motion

221 Seventh Street, Suite 200, Pittsburgh, PA 15238
(412) 828-1200
www.isquaredt.com

IFC 210R
Single Axis -- Momentum
Resolver Based Servo Control Module

User's Guide

(P/N: 5000-05)



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Integrated Industrial Technologies, Inc.
221 Seventh Street, Suite 200
Pittsburgh, PA 15238

Phone: (412) 828-1200
Fax: (412) 828-0320
WEB: http://www.isquaredt.com

In this Chapter you will learn about:

- Important User Information
- Product Warranty
- Return Policy
- Technical Support
- Assumptions
- Contents of This User's Guide
- IFC 210R Basics

1.1. Important User Information

To ensure safe and satisfactory operation of the equipment described in this user's guide, as well as the equipment connected to and used with your IFC 210R, all applicable local and national codes that apply to installing and operating the equipment must be followed.

WARNING ☞ Failure to comply with applicable local and national codes and standards can result in damage to equipment and/or serious injury to personnel.

Personnel responsible for the installation and/or operation of the equipment should study this user's guide and all referenced documentation prior to installation or operation of the equipment.

In no event is the provider of the equipment liable for any incidental, consequential or special damages of any kind or nature whatsoever, including but not limited to lost profits arising from or in any way connected with the use of this user's guide or the equipment.

The IFC 210R is designed to provide solutions for a wide variety encoder and servo applications. Therefore, it is the end user's responsibility to determine the acceptability of any products used in any application. The equipment provider assumes no responsibility for the User's misapplication of the IFC 210R.

Since I²T constantly strives to improve its products, we reserve the right to change this user's guide and any equipment mentioned herein at any time without notice.

1.2. Product Warranty

I²T warrants that all equipment they manufacture will be free from defects in materials and workman-ship for a period of one (1) year from the date of invoice. Within this warranty period, I²T shall, at its option, repair or replace – free of charge, any equipment covered by this warranty. This warranty does not cover any equipment damaged by improper installation, accident, alteration or misuse. In no event shall I²T be liable for incidental or consequential damages or for delay in performance of this warranty.

1.3. Return Policy

Any equipment returned as new must be in the original, unopened shipping carton and is subject to a 20% restocking fee. All equipment returned to I²T for repair or replacement, regardless of warranty status, must have return authorization. To receive return authorization, call the I²T technical assistance number with the following product information:

- Product Part Number
- Serial Number
- Description of Problem

I²T issues a Return Material Authorization (RMA) number. You must ship the product to I²T with shipping charges prepaid and the RMA clearly marked on the outside of the shipping container. Title and risk of loss or damage remains with the customer until shipment is received by I²T. All equipment returned for warranty repair must be in the original shipping container or additional handling charges apply. In special cases, I²T will provide emergency replacement of defective equipment. For special cases, the customer must provide a Purchase Order number in the amount of a product being shipped plus any applicable taxes and shipping charges. In the event that the defective equipment is not returned within seven (7) days, I²T bills the customer for the replacement equipment.

1.4. Technical Support

All I²T products are sold through authorized Schneider Electric high-tech distributors. The customer should attempt to resolve any problems through their local distributor before contacting I²T directly. Should your local distributor be unavailable or unable to solve a problem, contact I²T Technical Support at (412) 828-1200. Setup Software and Firmware updates are available via our WEB site at www.isquaredt.com.

1.5. Assumptions

To effectively use the IFC 210R User's Guide to install, develop and maintain your system, you should have a fundamental understanding of the following:

- Electronic concepts such as voltage, current, switches, etc.
- Motion control concepts such as position, velocity, acceleration, etc.,
- Ladder Logic programming skills
- Contents of this IFC 210R User's Guide.

1.6. Contents of This User's Guide

Each chapter provides a different level of help to get your system set up and ready to go. Below is a summary of each chapter's purpose.

Chapter / Appendix	Purpose
1 – Overview	Provides an overview of the items to be covered in this IFC 210R User's Guide.
2 – Introduction	Describes the IFC 210R and provides a brief overview of its features and design.
3 – Installation	Provides instructions for configuring, mounting and wiring the IFC 210R Momentum Single-Axis Resolver Based Servo Control Module.
4 – IFC 210R Windows Setup Software	Allows the user to configure and test the module in a Windows environment.
5 – PLC Programming	Describes the IFC 210R's user functions in detail and shows how to implement them in your application.
6 – Troubleshooting	Describes methods for isolating and resolving hardware and software problems. Describes the Diagnostics LEDs and the fault registers returned to the PLC.
A – Calculating User Units	Provides information on calculating user units.
B – Drawings	Provides drawings showing Module/Field interconnections and mechanical drawings of Modules, Resolvers, Motors, Drives and Cables.
C – Command Set List	Provides a list of the low-level commands that were available at the time of this printing. More up-to-date information is accessible in the HMI.
D – EFB Basics	Provides information on getting familiar with and the use of elementary function blocks designed for Concept Version 2.2.

1.7. IFC 210R Basics

This section provides the user with an understanding of the capabilities related to the IFC 210R. The IFC 210R is designed to be an easy-to-use single-axis resolver based servo control module. Some of the uses for the IFC 210R are described below.

1.7.1. Single-Axis Resolver Based Servo Control Module

This application uses the IFC 210R to read the position or velocity of a single channel directly into the Schneider Momentum PLC. A user loadable FN46 function block maps registers from the IFC 210R directly to the PLC. When using the function block, the position and velocity of the axis is written directly into PLC registers. For more complex applications, a command-response protocol (see Send Packet in *Section 4.3.1.3*) transfers commands to and from the IFC 210R from the PLC. The following is a list of I²T resolvers and cables that are compatible with the IFC 210R when using resolver feedback.

Part No.	Description
3000-01	Flange Mount Heavy-Duty Resolver, 90 deg Connector, IP65 Sealed
3000-02	Flange Mount Heavy-Duty Resolver, straight Connector, IP65 Sealed
4000-025	Resolver Cable, 25 foot
4000-050	Resolver Cable, 50 foot
4000-100	Resolver Cable, 100 foot
4000-150	Resolver Cable, 150 foot

Table 1-1: Resolver and Resolver Cables

1.8. Resolver Theory

This section gives the user a basic understanding of the theory behind the operation of a resolver.

A resolver is an analog trigonometric function generator. It has two primary windings located at right angles to each other in the rotor, and two secondary windings located at right angles to each other in the stator. See *Figure 1-1* below.

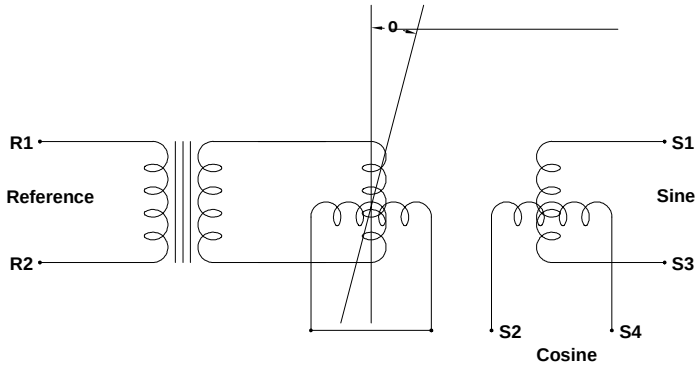


Figure 1-1: Brushless Resolver Schematic

When the rotor winding is excited with the rated input voltage (R1-R2), the output winding of the stator (S1-S3) will be proportional to the cosine of the rotor angle, and the output of the second stator winding (S2-S4) will be proportional to sine.

To establish a standard starting point, electrical zero is defined as the position of the rotor with respect to the stator at which there is minimum voltage across S2-S4. Nulls or zeroes will occur across S2-S4 at the 0 and 180 degree positions.

Because the resolver is an analog device and outputs are continuous through 360 degrees, the theoretical resolution of a resolver is infinite. In typical applications, the resolver resolution is limited by the resolution of the devices converting the analog signal of the resolver into a digital signal that can be used by a microprocessor.

Designers of motion control and feedback devices have argued about ideal solutions to velocity and position feedback problems. Resolvers have solved this problem by providing unlimited feedback resolution combined with the ability to survive in harsh environments.

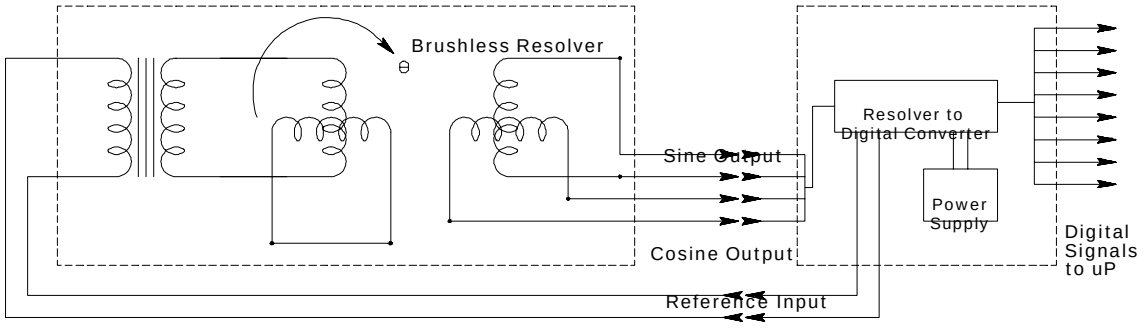


Figure 1-2: Typical Resolver

As can be seen in *Figure 1-2*, resolvers are basically rotating transformers, which modulate an AC signal with the mechanical rotation of the device. The resulting electrical outputs can be used to determine position and velocity of the device. The excitation signal E_x is transformed into sine and cosine windings so that outputs equal $E_x \sin\theta$ and $E_x \cos\theta$. The resolver to digital converter (R to D) calculates the angle:

$$\theta = \arctan(E_x \sin\theta \,/\, E_x \cos\theta)$$

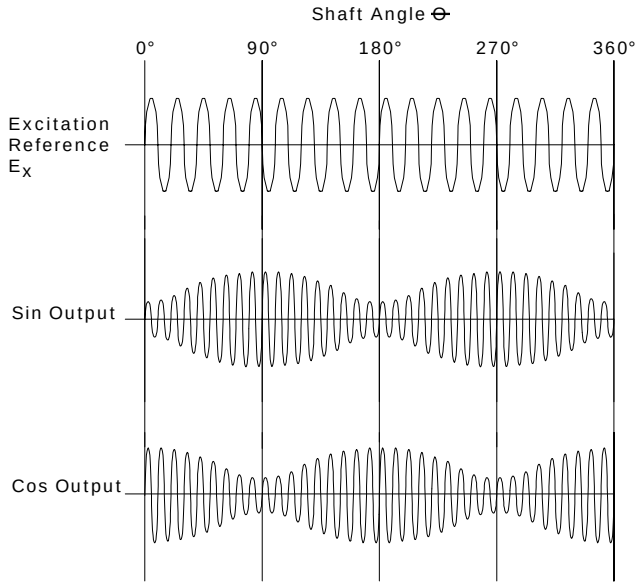


Figure 1-3: Shaft Angle θ

Since the output of the sine winding is divided by the output of the cosine winding, any injected noise whose magnitude is approximately equivalent on both windings is canceled. This provides an inherent noise rejection feature that is unique to resolvers.

Resolvers are ideal to design into applications where dust and airborne liquids can obscure optical encoder signals such as NC machines and presses. The resolver's inherent resistance to shock and vibration makes it uniquely suited to moving platforms such as those used on robots, gantries and transfer lines. Heat sensitivity is not a problem when using resolvers. Resolvers can be used for sensing position and velocity in high temperature applications such as petrochemical refining and chemical processes. I^2T offers several styles of resolvers which are defined in *Table 1-1*. For additional information on these resolvers, visit www.isquaredt.com or call (412) 828-1200 and request an information packet.

Each resolver offers the following features:

- Built for factory floor use
- High noise immunity
- Rugged metal construction with IP-65 Sealing
- Continuous duty to temperatures of +125°C
- Accuracy of ± 7 arc minutes

1.8.1. Single-Axis Resolver Based Servo Control Module

The IFC 210R can control a single resolver through a single-phase torque or velocity command to the servo drives (±10Vdc). The IFC 210R can easily perform complex motion functions using the loadable function block (for Schneider ProWorx NxT or Concept) developed by I²T. All motion programming is done via PLC logic. The following is a list of some of the motion functions available in the IFC 210R.

- Blended Moves
- High-speed Registration
- Input Position Latching
- Programmable Limit Switch Function
- Move Table with 16 Move Profiles
- Point-to-point, Absolute, or Index Moves

The following is a list of I²T motors, drives, resolvers, and cables that are compatible with the IFC 210R. Note, however, that third party motors with resolver can be used with this controller. Like the motors, the customer may choose to use third party servo drives.

Part No.	Description
BM75-RS	Servo Motor, NEMA 23, 75 oz-in, MS Conn, Single-speed Brushless Resolver
BM130-RS	Servo Motor, NEMA 23, 130 oz-in, MS Conn, Single-speed Brushless Resolver
BM200-RS	Servo Motor, NEMA 23, 200 oz-in, MS Conn, Single-speed Brushless Resolver
BM250-RS	Servo Motor, NEMA 34, 260 oz-in, MS Conn, Single-speed Brushless Resolver
BM500-RS	Servo Motor, NEMA 34, 510 oz-in, MS Conn, Single-speed Brushless Resolver
BM800-RS	Servo Motor, NEMA 42, 780 oz-in, MS Conn, Single-speed Brushless Resolver
BM1400-RS	Servo Motor, NEMA 42, 1365 oz-in, MS Conn, Single-speed Brushless Resolver
BM2000-RS	Servo Motor, IEC, 130 in-lb, MS Conn, Single-speed Brushless Resolver
BM3400-RS	Servo Motor, IEC, 210 in-lb, MS Conn, Single-speed Brushless Resolver
BM4500-RS	Servo Motor, IEC, 280 oz-in, MS Conn, Single-speed Brushless Resolver
BA10	Servo Drive, 5A Cont, 10A Peak, 120Vac
BA20	Servo Drive, 10A Cont, 20A Peak, 120Vac
BA30	Servo Drive, 15A Cont, 30A Peak, 120Vac
BA50	Servo Drive, 25A Cont, 50A Peak, 230Vac, 3-phase
BA75	Servo Drive, 37A Cont, 75A Peak, 230Vac, 3-phase
BA100	Servo Drive, 50A Cont, 100A Peak, 230Vac, 3-phase
PFC-XX	Cable, Servo Motor Resolver to Module Feedback (15 ft. or 30 ft.)
PMC1-XX	Cable, Drive to Motor for BM500, BM800, BM1400 (15 ft. or 30 ft.)
PMC2-XX	Cable, Drive to Motor for BM2000, BM3400, BM4500 (15 ft. or 30 ft.)
4007-015	Cable, Module-to-Drive, 3 Foot

Table 1-2: Motors w/Resolvers, Amplifiers, and Cables

In this Chapter you will learn about:

- Product Description
- Product Features
- Hardware Block Diagram

2.1. Product Description

The IFC 210R is a Momentum PLC servo module that provides a single-channel of resolver feedback control. I²T manufacturers this module using the latest hardware components and surface-mount technology. The IFC 210R is certified by Schneider Electric (previously Modicon) to be a ModConnect/Schneider Alliance product.

The IFC 210R can operate as a Servo Controller, an Intelligent Feedback Device, or a Programmable Limit Switch as described in *Table 2-1*.

Module Application	Description
Servo Controller	Position control of servo, flux vector or DC motor and drive. Capable of controlling the velocity loop and torque loop in some applications.
Intelligent Feedback Device	Monitoring of resolver position, speed and status.
Programmable Limit Switch	Setting outputs based on speed or position (functions as a PLS).

Table 2-1: Operational Modes of the IFC 210R

Users may configure the IFC 210R with the supplied Universal HMI Windows Setup Software (P/N 2000-03). This software package runs on a user supplied Pentium 90 or greater (IBM compatible) running Windows 95, 98, NT or 2000. The module configuration data is entered via a PC or downloaded to the IFC 210R via an RJ45 serial programming port on the front of the IFC 210R (see *Figure 3-1* for location of this port). The configuration data is stored in the Flash Memory of the IFC 210R so that data is maintained during a power loss.

I²T developed a user loadable function block (FN46) for use with the IFC 210R to make programming the module easy (see *Chapter 5*). The FN46 User Loadable provides nine functions that are summarized in *Table 2-2*.

Function	Description
0	Get Loadable Version
1	Read Position, Speed, Status and Programmable Limit Switch Monitor
2	Axis Homing
3	Point-to-Point Move Profile
4	Download 16-Point Move Table
5	Execute 16-Point Move Table
6	Copy Setup Configuration from Module to PLC
7	Copy Setup Configuration from PLC to Module
8	Send Generic Low-level Commands

Table 2-2: Functions of the FN46 User Loadable

2.1.1. Function 0 – Get Loadable Version

Returns the version of the loadable.

2.1.2. Function 1 – Position, Speed, Status and PLS Monitor

Allows the IFC 210R to write position, velocity and diagnostic information directly into user-defined PLC registers.

2.1.3. Function 2 – Axis Homing

Allows the axis to initiate a homing sequence. The user loads the appropriate PLC registers with the speed and direction of the homing move.

2.1.4. Function 3 – Point-to-Point Move Profile

Point-to-Point moves are accomplished by loading the appropriate registers of the function block with the desired position, speed, acceleration and deceleration of the move. An additional register in the function block identifies the move as Absolute, Incremental Negative or Incremental Positive.

2.1.5. Function 4 – Download 16-Point Move Table

Load up to sixteen move table entries to the IFC 210R. Each table entry contains a position, velocity, acceleration and deceleration. Once the **Move Table** is loaded to the IFC 210R, it is possible to initiate the move with Function 5.

2.1.6. Function 5 – Execute 16-Point Move Table

By setting bits in a register from the PLC, users can execute any of the 16 move positions. A corresponding bit in another PLC register is set when the move completes.

2.1.7. Function 6 – Copy Setup from Module to PLC

Copy the IFC 210R Setup Data to the PLC. The setup data can then be downloaded to a new module without using the HMI Windows Setup Software.

2.1.8. Function 7 – Copy Setup from PLC to Module

Copy setup data to the IFC 210R that was previously saved to the PLC using Function 6 described above.

2.1.9. Function 8 – Send Generic Low-level Commands

Allows the PLC to execute a low-level function.

2.2. Product Features

The IFC 210R incorporates many features. Each feature is described below.

2.2.1. Module Type

Momentum PLC compatible Single-Axis Resolver Based Servo Control Module that controls the position and speed of a servo, flux vector, variable frequency, or DC drive and motor.

2.2.2. Resolution

Fourteen or sixteen bits auto-switching base on speed or 16,384 or 65,536 counts per revolution.

2.2.3. Information Throughput

Reads position and calculates velocity every 500 microseconds. Presents data to the PLC every scan.

2.2.4. Resolver Feedback

The user may use any transmit type resolver. Although it is the responsibility of the purchaser to ultimately choose which type of resolver to use, we recommend an I^2T brushless resolver (P/N 3000-XX) to ensure the best possible performance. Auto voltage referencing circuit allows use of different resolvers with varying cable lengths and transformation ratios on each channel

2.2.5. Resolver Channel

The IFC 210R has one resolver channel that can be scaled in user units and read into a PLC register.

2.2.6. Input Channel

One 16-bit resolution resolver input channel. This requires the connection of a single-turn resolver.

2.2.7. User Definable Inputs

The IFC 210R supports five onboard user definable inputs controlled by the PLC logic.

2.2.8. Predefined Inputs

There are four predefined 10 to 30 Vdc limit inputs for the axis that include FWD, REV, Home and Drive Fault.

2.2.9. User Discrete Outputs

The IFC 210R has eight user sinking outputs 10 to 24Vdc (40mA each) and eight sourcing outputs rated at 1A @ 24Vdc.

2.2.10. Predefined Output

There is one dedicated axis enable output “Drive Enable” for the IFC 210R.

2.2.11. Analog Outputs

The IFC 210R design allows for two analog outputs on the axis. Under servo control this output is 16-bit. The analog outputs can be used to control a DC Variable Frequency or Flux Vector drive for velocity control. In 3-phase brushless mode, the IFC 210R uses the two analog outputs to communicate to the servo motor. The IFC 210R also provides a third (derived) phase to satisfy drives that require all three phases.

2.2.12. Point-to-point Moves

Point-to-point moves are accomplished with linear or s-curve acceleration.

2.2.13. Sixteen-Point Move Table

Onboard sixteen-point move table with configurable positions, speeds, accel/decel parameters. Execute moves individually or blend groups using linear or s-curve accels/decels. Modify points on-the-fly from the PLC, excluding the point being executed.

2.2.14. Registration Function

Registration function with phase advance and retard

2.2.15. Profiling

Profiling from a virtual axis is available as an enhanced firmware option.

2.2.16. Resolver Signal

Automatic resolver reference signal adjustment provides optimal feedback performance. Multi-mode 984 PLC Function Block (FN46) allows the user to execute motion from Modsoft, Schneider Electric ProWorx Plus, Schneider Electric ProWorx NxT, and the 984LL editor of Concept

2.2.17. Concept EFBs

Concept EFB motion tool kit is optional for Concept Version 2.2 SR2 by requesting part number 2000-04.

2.2.18. Windows Setup Software

Software is included for interface to Windows 95, 98, NT or 2000 for simplified module configuration, motion profile definition, system testing and monitoring. The software is complete with a graphical tool package for axis tuning and motion profile development.

2.2.19. Compatibility with Legacy Products

The IFC 210R is capable of interfacing to Schneider Electric's legacy Cyberline Analog Servo Drive.

2.2.20. Function Blocks

Users may program motion using the FN46 User Loadable Function Block written for Schneider Electric's ModSoft, ProWorx Plus, ProWorx NxT and Concept.

2.2.21. Move Profiles & Blended Moves

The IFC 210R has sixteen positions, speeds, accels and decels stored in memory. This allows the PLC to execute individual move profiles or blended moves to create a complex move.

2.2.22. Registration Function

The IFC 210R permits registration for labeling and packaging applications.

2.2.23. Parameter Storage

Provides On-board Flash Memory for storage and retrieval.

2.2.24. External Voltage Requirements

External 24Vdc @ 1.3 Amps must be supplied by the customer. This is also available from I²T as P/N 6000-06.

2.2.25. Environmental Conditions

- Operating Temperature: 0 to 60°C
- Relative Humidity: 5 to 95% (Non-condensing)
- Storage Temperature: -40 to 85°C

In this Chapter you will learn about:

- Inspecting the Shipment
- Typical System Components
- List of Components
- Installation Precautions
- Panel Layout
- IFC 210R System Wiring

3.1. Shipment Inspection

Check your IFC 210R packages, upon receipt, for obvious damage that may have occurred during shipment. Report any damage to the shipping company immediately. I²T cannot be held responsible for damage incurred during shipment. Along with your IFC 210R Resolver Based Servo Control Module (P/N 1003-02), the following should be included:

- HMI Windows Setup Software (P/N 2000-03)
- User's Guide (P/N 5000-05)

Retain the shipping container in case you need to return the IFC 210R for any reason. Any damage incurred due to improper packing is the responsibility of the shipper and will further delay the repair or replacement of your parts. Motors, resolvers, drives and cables are each shipped in separate containers. It is necessary to also inspect these items for damage as they are received. Again, retain your shipping containers in the case that you may need to return your products for any reason.

Figure 3-1 shows a diagram of the parts necessary to setup and operate a typical IFC 210R control system.

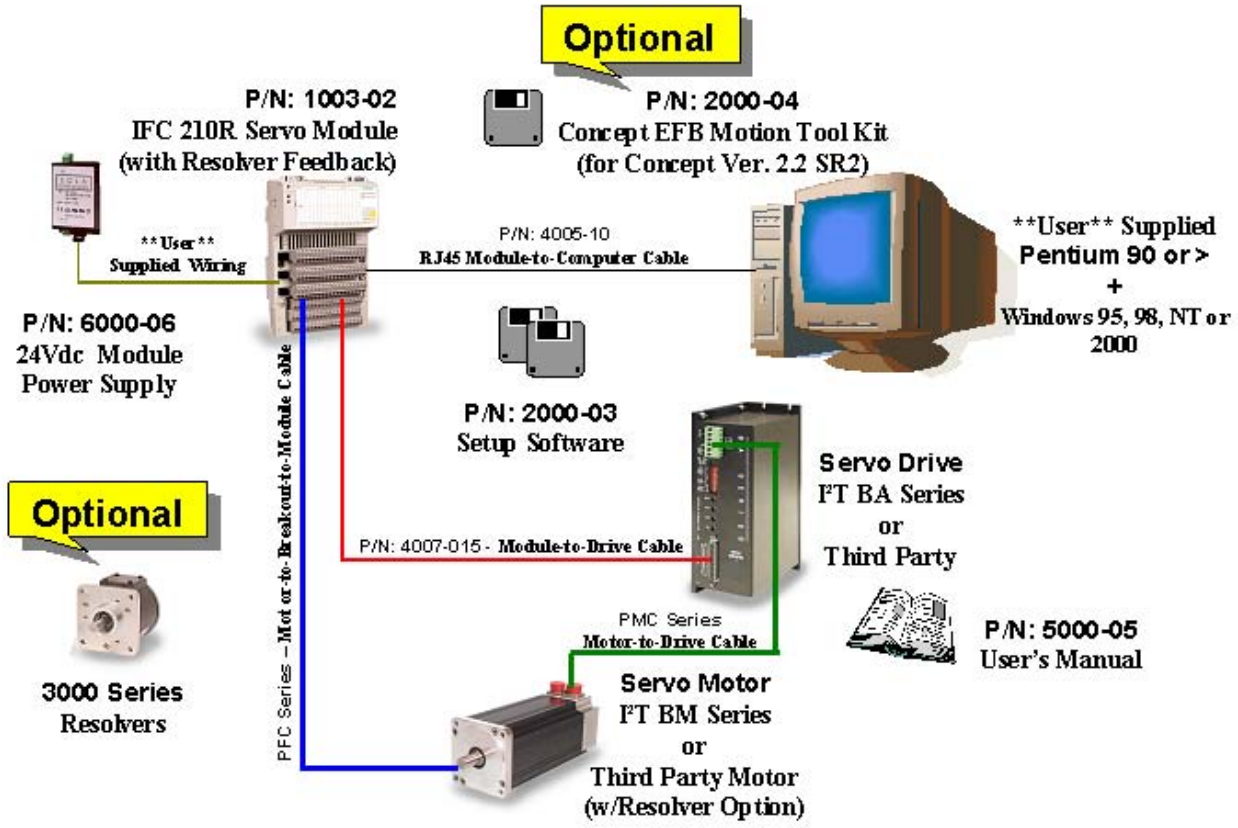


Figure 3-1: Typical Servo Control System

3.2. Typical System Components

Refer back to *Table 1-1* and *Table 1-2* for a complete list of system components that I²T supplies. Our broad selection of components allows you to put together a complete IFC 210R servo control system with resolver feedback. If a component you are looking for is not listed, call the I²T technical support team (412-828-1200) for availability.

3.3. Installation Precautions

Before installing your IFC 210R, there are several precautions to take. If for any reason you are unsure about your system design, call your I²T distributor or the I²T technical support team before completing your design.

3.3.1. Electrical Noise

Before installing your IFC 210R, observe the following installation precautions to minimize the possibility of electrical noise.

CAUTION ☞ **Do not route high-voltage wires and low-level signals in the same conduit.**

Ensure all components are properly grounded.

Ensure all wiring is properly shielded. All shields should only be tied to the earth ground pin on the IFC 210R. This terminal must then be tied to a good earth ground.

Always use twisted-pair shielded cables when running signals.

Always use isolated circuits for remote signals. Use isolated analog and digital signals when possible.

Never cut the resolver cable to land on a terminal strip. Always run this cable from the resolver directly to the IFC 210R. This keeps the shielding scheme intact and minimizes the possibility of creating ground loops.

Put surge suppression components on all electrical coils: resistor/capacitor filters, MOVs, Zener and clamping diodes.

3.3.2. Heat & Humidity

All PLC equipment should be housed in an enclosure that prevents exposure to dirt, dust, liquids and harsh environments. To ensure personal safety and long life of your IFC 210R, pay special attention to the environmental conditions below.

NOTE ☝ **Always operate your IFC 210R at an ambient temperature between 0 and 60°C.**

Always store your IFC 210R at an ambient temperature between -40 and 85°C.

Maintain a relative humidity below 95% (Non-condensing).

3.4. Panel Layout

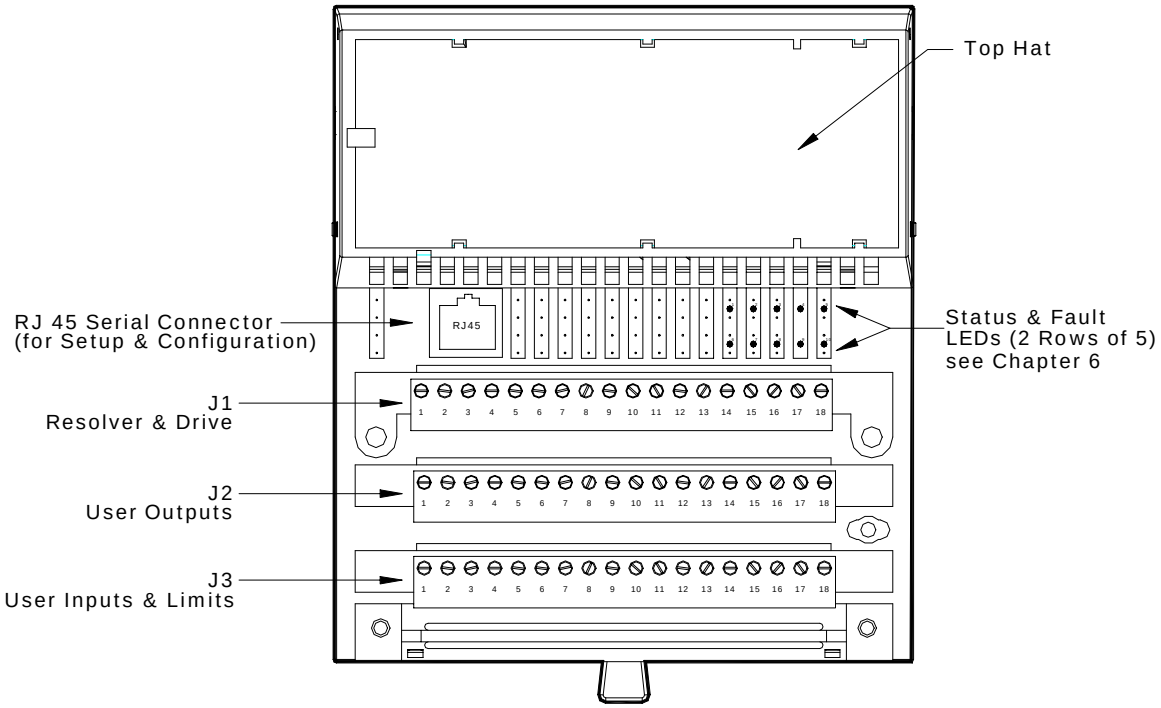
Install your IFC 210R in an enclosure that will protect it from atmospheric contaminants such as oil, metallic particles, moisture and dirt. The National Electrical Manufacturers Association (NEMA) established standards that define the degree of protection electrical enclosures provide. The enclosure that you use for PLC equipment should minimally conform to a NEMA 12 standard.

The IFC 210R mounts on a DIN rail in any Momentum PLC local or remote I/O. You will need a 24Vdc power supply capable of delivering 1.3 Amps (P/N 6000-06) to drive the Digital I/O and Analog Outputs.

NOTE **Due to EMI generated by power switching devices, any device mounted in the same control panel as the IFC 210R should be located as far away as possible from PLC equipment and should have surge-suppressing devices installed on their terminals. This includes motor contactors, starters and relays.**

3.5. System Wiring Connections

The following sections explain how to wire your IFC 210R to an I²T servo motor, an Over-travel and Home Limit Switch, and a Power Supply. The following (in order of the terminal block pins seen on the front of the IFC 210R) identifies the connections on the IFC 210R.



3.5.1. Resolver & Drive Connections (Top Connector)

Table 3-1 identifies the IFC 210R resolver and drive connections for the axis.

To minimize induced noise, run the resolver wire in its own conduit away from power cables. Resolver cables are available from I²T in 25, 50, 100, and 150 ft. lengths (P/N 4000-XXX). See *Appendix B* for this cable.

To read accurate, jitter-free position values from the IFC 210R, you must keep the resolver signals clear of electrical noise. To do this, run the resolver wiring away from high-voltage signals and use shielded twisted-pair cable for the resolver signals.

To avoid potential noise problems, resolver shields must be tied to earth ground (Pin 7 or Pin 14). Do not tie shields to the power supply common.

The resolver is connected to terminals 1 through 7. Connect the shield of the resolver to terminal 7. Make sure that terminal 7 is connected to cabinet ground, which is connected to your building ground. A machine fault can be connected to terminals 15 and 16. Connect 24Vdc @ 1.3 Amps power supply, (recommend I²T P/N 6000-06) to terminals 17 and 18.

Pin No.	Signal Name	Description
1	REF+	Resolver Reference +
2	REF -	Resolver Reference -
3	SIN +	Resolver Sine +
4	SIN -	Resolver Sine -
5	COS+	Resolver Cosine +
6	COS-	Resolver Cosine -
7	Shield	Shield
8	Phase A, ANA1+	Analog Output 1
9	Phase B, ANA2+	Analog Output 2
10	Phase C	Derived Third Phase
11	Common	Common
12	Shield	Shield
13	Enable	Drive Enable
14	Common	Common
15	FLT+	Fault Input +
16	FLT-	Fault Input -
17	+24VDC	+ 24 Vdc Power Connection
18	PS COM	24 Vdc Power Supply Common

Table 3-1: Resolver & Drive Connections (J1 – Top Connector)

3.5.2. User Outputs (Middle Connector)

Table 3-3 identifies the user output connections for the axis.

The IFC 210R has eight user definable sinking outputs and eight user definable sourcing outputs that can be controlled directly from the PLC program. The user outputs are 24 Vdc sinking at 0.25 Amps. (See the **Output** dialog box under **Setup** in *Chapter 4*.)

Pin No.	Signal Name	Description
1-8	User Outputs - Source	Sourcing Outputs, User Defined
9	Common	Common
10-17	User Outputs - Sink	Sinking Outputs, User Defined
18	Common	Common

Table 3-2: User Outputs (J2 – Middle Connector)

3.5.3. User Inputs & Limits (Bottom Connector)

Table 3-2 identifies the limit and user input connections to the standard IFC 210R (P/N 1003-02).

A 24Vdc power supply (P/N 6000-06) must be connected to the IFC 210R for isolation voltage generation. This same power supply can be used to feed voltage to the Over-travel and Home Limit Switches. It is necessary to connect a normally closed (N.C.) type limit switch to the FWD (Pin 1) and REV (Pin 2) limit switch pins for the axis. This is a fail-safe connection that faults the axis in the event continuity is broken in this circuit. You may connect a normally closed (N.C.) or normally open (N.O.) limit switch to the Home Limit Switch (Pin 3).

Pin No.	Signal Name	Description
1	Ax FWD EOT	Forward Over-travel on the Axis
2	Ax REV EOT	Reverse Over-travel on the Axis
3	Ax Home	Home the Axis
4	User Input #1	Function Driven or Generic Input 1
5	User Input #2	Function Driven or Generic Input 2
6	User Input #3	Function Driven or Generic Input 3
7	User Input #4	Function Driven or Generic Input 4
8	User Input #5	Function Driven or Generic Input 5
9 - 10	Input Common	Input Common
11 - 18	NC	No Connection

Table 3-3: Limit Switch Connections (J3 – Bottom Connector)

In this Chapter you will learn about:

Software Installation

Running the Setup Software

Using the Setup Software

4.1. Software Installation

Before attempting to install the 32-bit universal HMI Setup Software on your computer, verify that your system meets the following requirements.

- Pentium 90 or higher
- Microsoft Windows 95, 98, NT, 2000 or XP
- 8 MB of RAM or higher
- 12 MB Hard Disk (free space) or higher
- CD-ROM drive
- VGA Monitor or higher

The Universal HMI Setup Software (P/N 2000-03) is used to configure the IFC 210R during installation. I²T includes this Setup Software with the IFC 210R Momentum I/O Base Servo Control Module on an *Install* CD.

This *Install* CD can install the following applications:

HMI Setup Software, MPL Development Environment, PLS Interface Software.

Also, Firmware and Loadables for all I²T Modules.

The following procedure explains how to install the Universal HMI Setup Software onto your hard disk:

1. Insert the *Install* CD into the CD-ROM drive.
2. If your system supports the auto-run feature, installation will start automatically.

   If your system does not support the auto-run feature, select **Start** on the task bar, select **Run**, then enter the letter of the CD-ROM drive and the word Install.exe (example: D:\Install.exe).
3. Follow the instructions as they appear.

4.2. Running the Setup Software

Before proceeding, you must have successfully completed the software installation described in *Section 4.1*.

Next, connect your PC to the IFC 210R Momentum I/O Base Servo Control Module using an I²T RJ45 Momentum Programming Cable (P/N 4005-10). For a detail drawing of this cable, see *Appendix B.*

4.2.1. Windows 95/98/NT/2000/XP Startup

To begin running your IFC 210R, start Windows 95, 98, NT, 2000 or XP and double click on the I²T "HMI Setup Software" icon that was previously installed on the Windows desktop during the installation.

The software automatically establishes the baud rates and serial port parameters to match your IFC 210R module.

To verify that your PC is communicating with the IFC 210R, check to see if the #2 Green LED (Top Row) is flashing on the front of the module and that the computer screen indicates "I²T Module Interface - Connected to IFC 210R Momentum I/O Base Servo Control Module".

Another way of verifying communications is that the icons on the software tool bar change from gray to color

4.3. Using the Setup Software

Help files were placed on your hard drive during the install procedure in section 4.1. Please refer to these files for details on using the Universal HMI Setup Software and for a listing of the command packets used to communicate with the IFC 210R module.

To access the help files simply press the **F1** key or use the **Help** Pull-down Menu and select **Help Topics**.

NOTE ☝ **Once you finish setting up the IFC 210R parameters, Copy them to Flash (under the *Module* Pull-down Menu) Memory so they will not be lost during power-down.**

NOTE ☝ **Any Windows Setup Software function described in the *Help Topics* can also be done in real-time by issuing commands from the PLC. The IFC 210R uses a User Loadable Function Block (FN46) to make programming the module easy. If your PLC programming software requires that you have the loadable in a specific directory, you must copy the FN46.dat file to that directory.**

In this Chapter you will learn about:

PLC Configuration

Using User Loadable

5.1. PLC Configuration

The IFC 210R Resolver Based Servo Control Module can be used with any Schneider Electric Momentum processor or communication adapter. This allows the IFC 210R to be I/O mapped into any Momentum, Quantum or "E" series slot mount PLC network. The IFC 210R controls the motion of a single axis from the PLC logic. A user loadable function block (FN46) is provided with the IFC 210R to allow the user to program motion using the traditional 984 Ladder Logic programming language (ModSoft, Schneider Electric ProWorx Plus, Schneider Electric ProWorx NxT, and the 984 Ladder Logic language of Concept). I²T provides an optional EFB motion tool kit used to program motion in the function block programming section of Concept (P/N 2000-04). The FN46.DAT file is included with the Windows Setup Software on two 3-1/2" diskettes. The following are the nine modes of operation of the FN46 function block:

Mode 0. Get Loadable Version

Mode 1. Position, Speed, Status and Programmable Limit Switch Monitor

Mode 2. Axis Homing

Mode 3. Point-to-Point Move Profile

Mode 4. Download Sixteen-Point Move Table

Mode 5. Execute Sixteen-Point Move Table

Mode 6. Copy Setup Configuration from IFC 210R to PLC

Mode 7. Copy Setup Configuration from PLC to IFC 210R

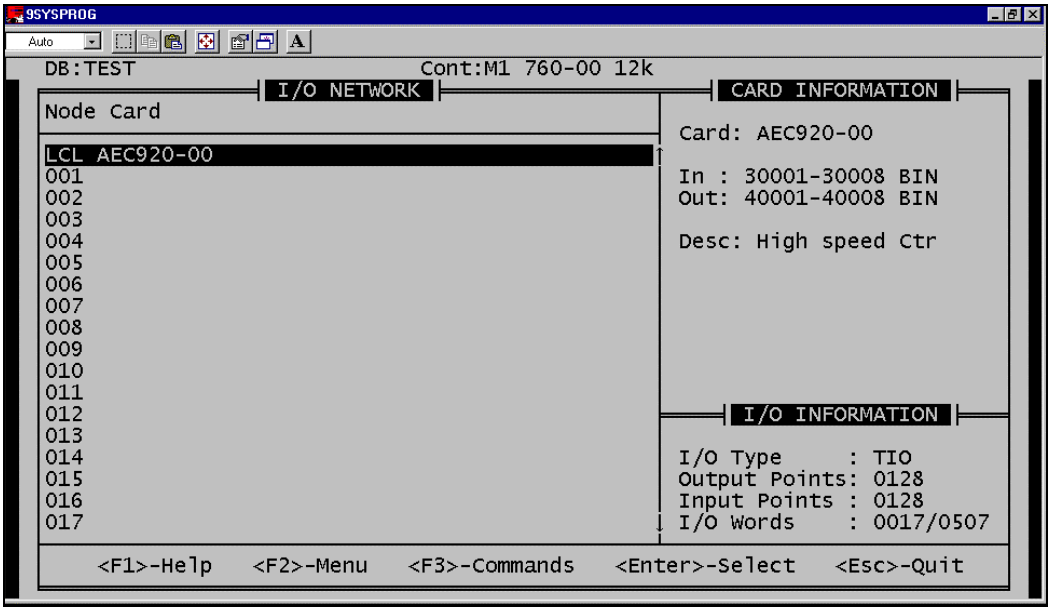
Mode 8. General Low-level Commands

Each of the nine modes of operation is described in this chapter. You can program the IFC 210R with or without the FN46 User Loadable. This loadable is designed to make modes of operation easy to program from ladder logic. Install the FN46 loadable according to the instructions in the Configuration menu of your programming software (ModSoft, ProWorx, ProWorx NxT or Concept).

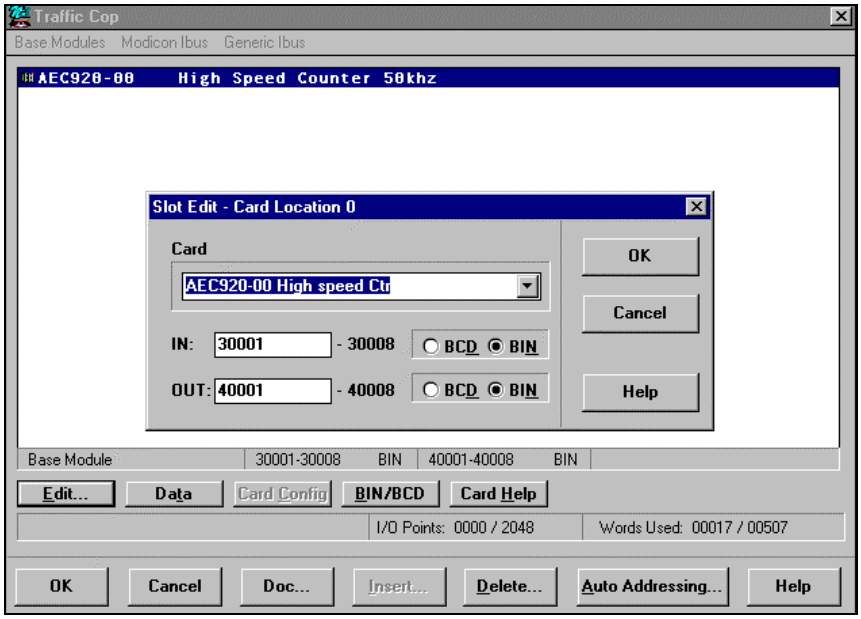
NOTE **The IFC 210R can be used with the Schneider Electric Concept Programming package. The FN46 Function Block can be used in the 984 Ladder Logic programming section of Concept. *Appendix D* covers the basics of programming the module using I²T EFBs. For the most up-to-date and valid data on EFBs, I²T recommends the use of the on-line help files from the EFB motion tool kit.**

5.1.1. I/O Mapping the Module

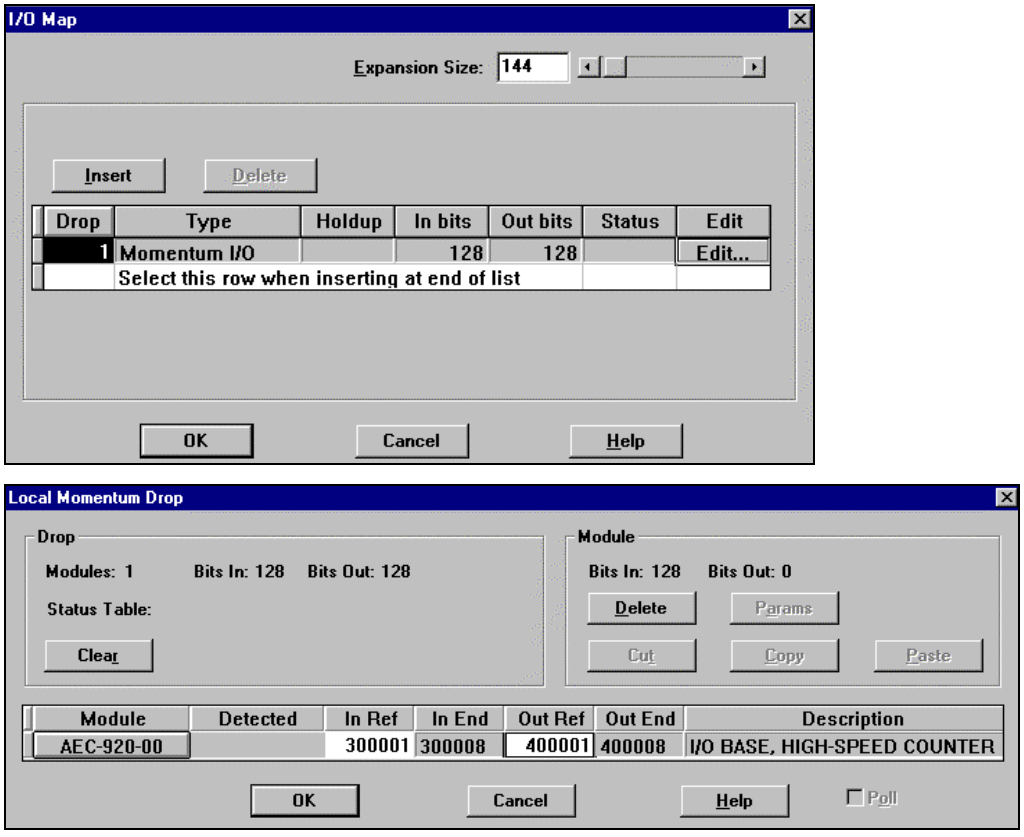
Knowledge of programming Momentum and the Schneider Electric line of PLCs is critical to properly install and program the IFC 210R. The procedures in the following sections may vary based on the type of programming software and PLC hardware used. The IFC 210R can be I/O mapped after the FN46 loadable is installed in the PLC configuration section of the PLC programming software. The IFC 210R is I/O mapped as an AEC920-00 High Speed Counter Module that uses eight binary (BIN) bi-directional registers (4XXXX and 3XXXX). The following screens are examples of how the IFC 210R is I/O mapped using the different PLC programming packages:



Screen 5-1: I/O Mapped using Schneider Electric ProWorx Plus PLC Programming Software



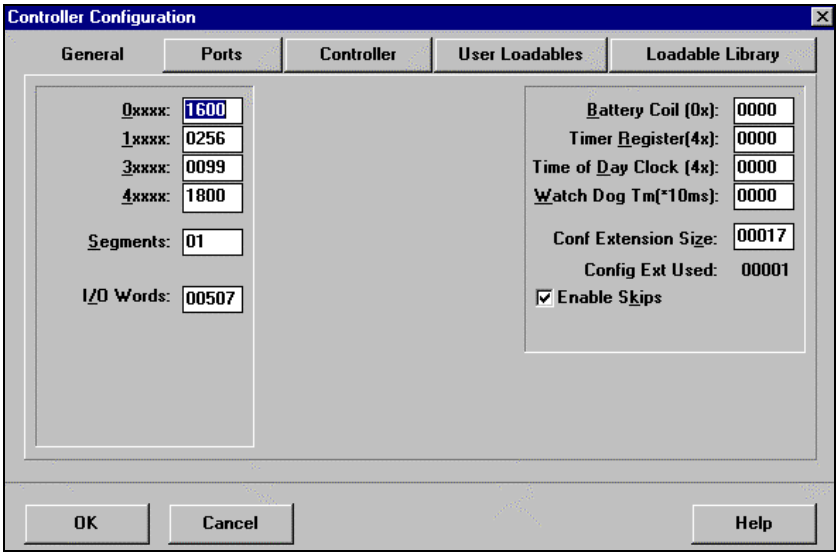
Screen 5-2: I/O Mapped using Schneider Electric ProWorx NxT Programming Software



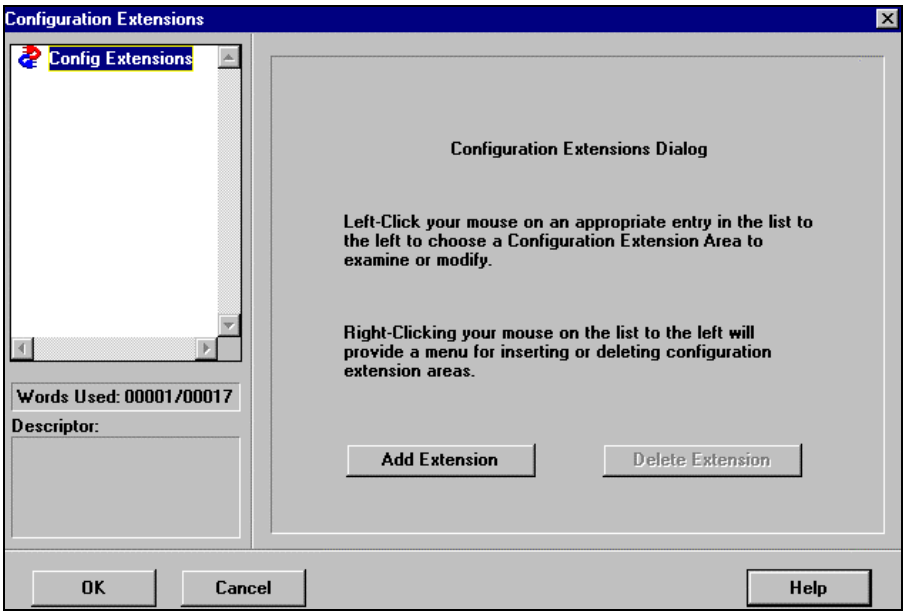
Screen 5-3: I/O Mapped using Schneider Electric Concept Programming Software

5.1.2. Peer-Copping the Module in a Modbus Plus Network

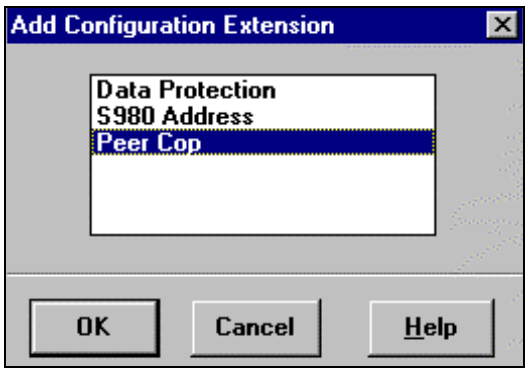
The IFC 210R can be used with a Modbus Plus communication adapter in a Quantum, an "E" series slot mount or a Momentum Modbus Plus network. This example uses Schneider Electric ProWorx NxT programming software to peer-cop the IFC 210R as specific I/O on address 2 on the MB+ network. After peer-copping the module, the FN46 User Loadable sends commands to the IFC 210R via the 8 bi-directional registers setup in the specific I/O dialog box.



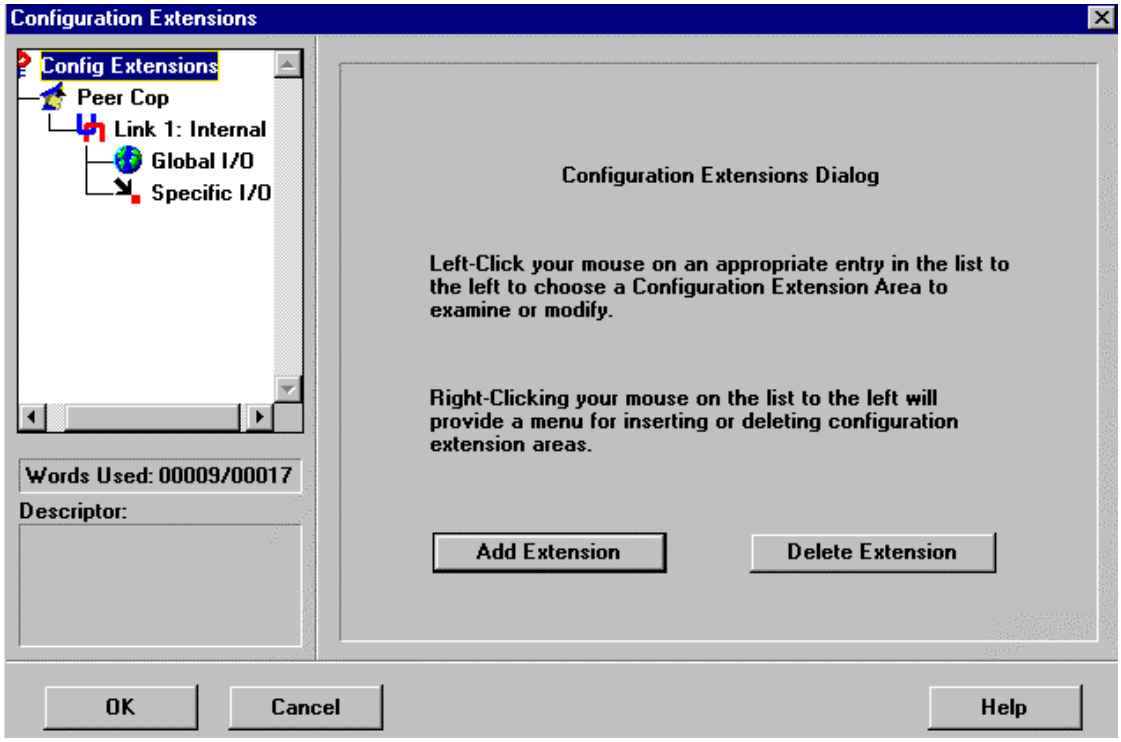
Screen 5-4: Set Configuration Extension Size to 00017 for one MB+ Node under the General Tab of the Controller Configuration Box. Extra Nodes require additional words.



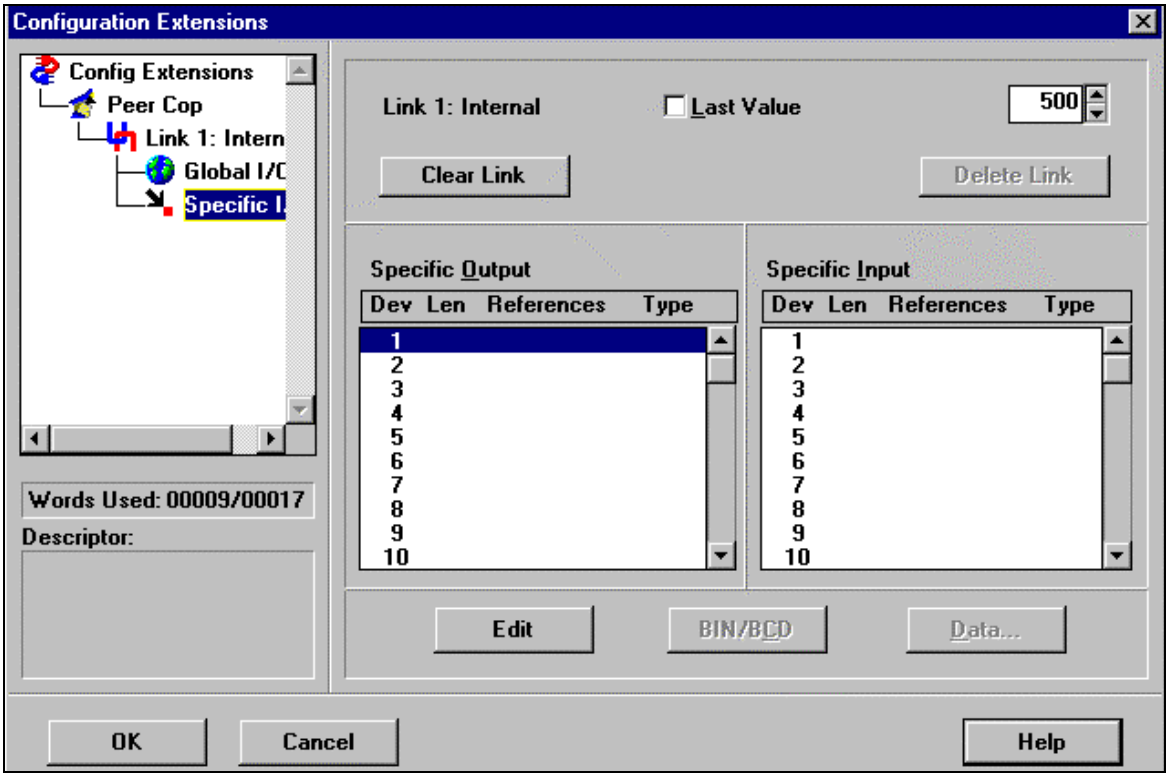
Screen 5-5: Select Add Extension Under Configuration dialog box



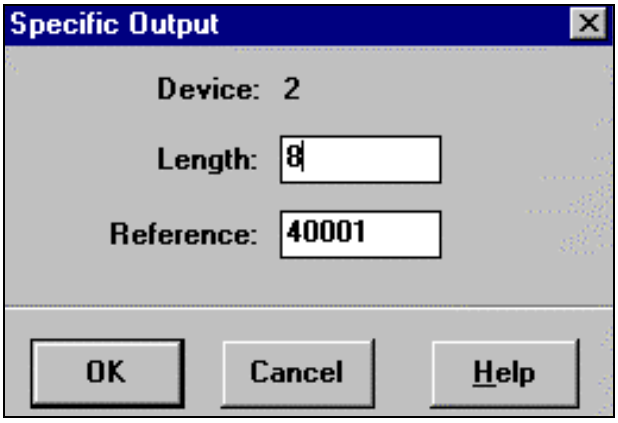
Screen 5-6: Select Peer Cop in the Add Configuration dialog box



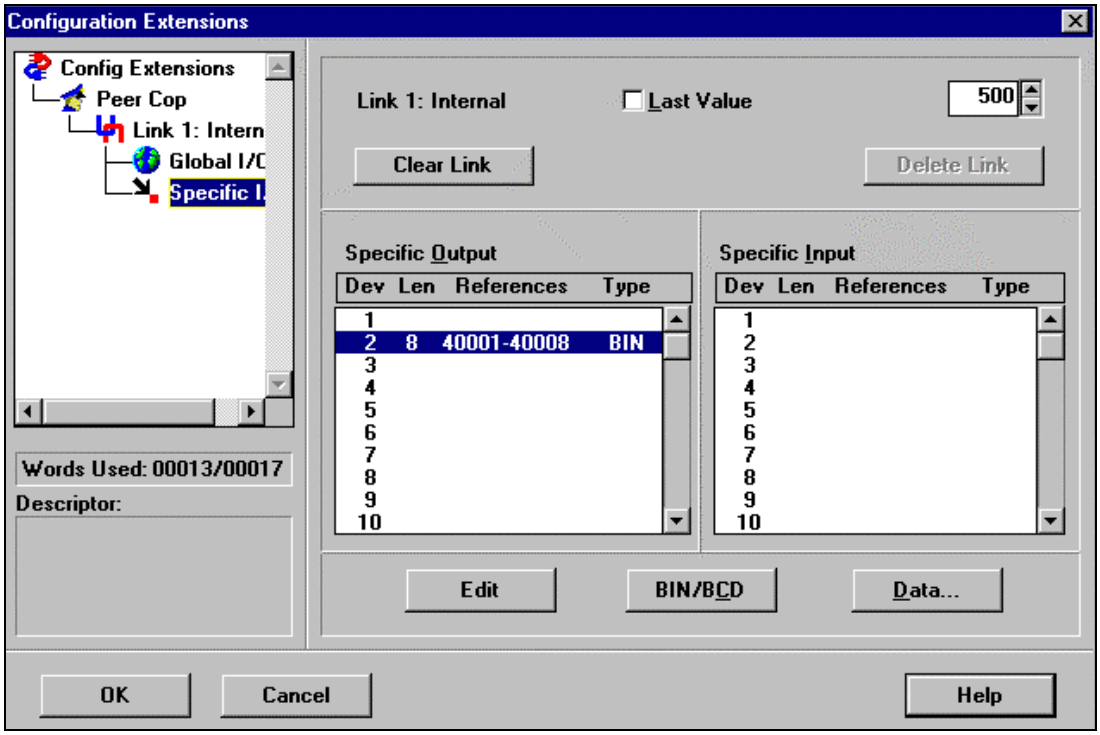
Screen 5-7: Configuration dialog box from selecting Peer Cop



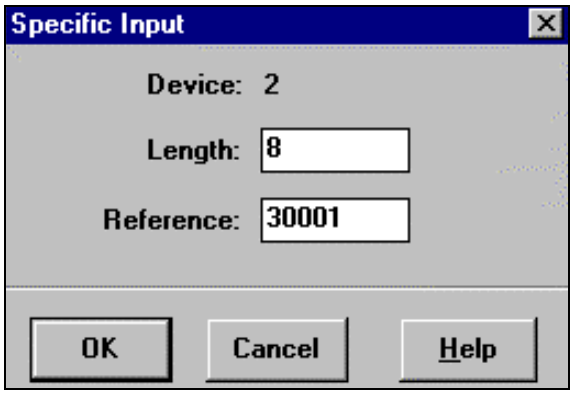
Screen 5-8: Select Specific I/O, Select 2 in the Specific Output Field, and then Select Edit



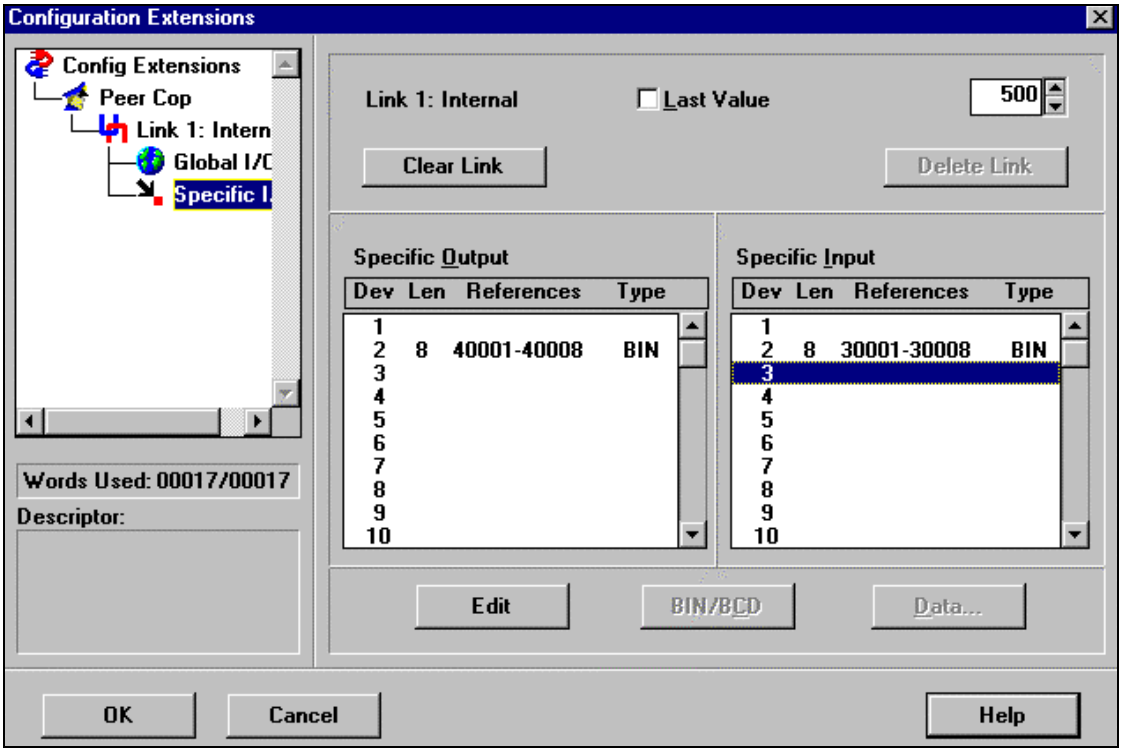
Screen 5-9: Enter 8 in Length Field. In Reference Field enter the starting 4XXXX Register for 8 consecutive registers that will peer-cop as specific I/O to the IFC 210R. Press OK after entering data.



Screen 5-10: Select Specific I/O, Select 2 in Specific Input Field, and then Select Edit



Screen 5-11: Enter 8 in Length Field. In Reference Field, Enter Starting 3XXXX Register for 8 Consecutive Registers that will Peer-cop as Specific I/O to the IFC 210R. Press OK after entering data.



Screen 5-12: Configuration Extensions Dialog Box

The dialog box in *Figure 5-12* should appear. Press **OK** to Peer-Cop the IFC 210R as Address 2. Specific I/O as Registers 40001-40008 and 30001-30008 in the Modbus Plus Network. Note that seventeen words were used in the Configuration Extension Area.

After I/O mapping the IFC 210R, put the PLC in the RUN state and verify that the IFC 210R LEDs (see Troubleshooting, *Chapter 6*) are in the following state:

1. Ensure the IFC 210R Heartbeat LED is blinking.
2. Ensure the IFC 210R PLC Communication Active LED is on.
3. Ensure the following Fault LEDs are NOT on.
    - Serial Communications Fault
    - PLC Communications Fault
4. Log onto the Momentum PLC processor or system PLC with ProWorx Plus, ProWorx NxT or Concept.
5. Enter a command in the 1st I/O mapped write register to the IFC 210R. The same command should be echoed back in the first I/O mapped read register. If the read register does not have the same command as the write register, make sure that no other modules are I/O mapped to the same registers. Check that no PLC logic is overwriting these registers (i.e., 40001 = 10003, 30001 = 10003). ***For example***, place a 1001 in 40001. A 1001 should appear in 30001.

5.1.3. Configuring the Module

The IFC 210R contains default setup information established at the factory. To use the IFC 210R with your mechanical configuration, you must first configure the IFC 210R using the provided HMI Windows Setup Software (*Chapter 4*). Once you configure the module, write the configuration data to Flash RAM for storage. The configuration data is read from the Flash RAM on each subsequent power-up of the IFC 210R. It is only necessary to change configuration data when a mechanical part of the system changes (i.e., Gear Ratio). To save the configuration to Flash RAM, select **Copy Setup to Flash** under the **Comm** menu of the HMI Software.

5.2. IFC 210R I/O Map Register Description

The IFC 210R is I/O mapped as an AEC920-00 High Speed Counter Module that uses eight binary (BIN) bi-directional registers (4XXXX and 3XXXX). The first 6 input and 6 output registers are used to send and receive data back-and-forth to the IFC 210R. The 7th and 8th input and output registers are used to send control and status information to and from the IFC 210R. The following describes the I/O mapped registers of the IFC 210R.

5.2.1. I/O Map Registers

Register	Description	Register	Description
4XXXX+0	Command Register	3XXXX+0	Echo Register
4XXXX+1	Data to IFC 210R	3XXXX+1	Data from IFC 210R
4XXXX+2	Data to IFC 210R	3XXXX+2	Data from IFC 210R
4XXXX+3	Data to IFC 210R	3XXXX+3	Data from IFC 210R
4XXXX+4	Data to IFC 210R	3XXXX+4	Data from IFC 210R
4XXXX+5	Data to IFC 210R	3XXXX+5	Data from IFC 210R
4XXXX+6	Control Register	3XXXX+6	Status Register
4XXXX+7	User Output Register	3XXXX+7	Axis and User Input Register

5.2.2. Control & Status Register Bits

Control Register 4XXXX+6		Status Register 3XXXX+6	
Bit	**Description**	**Bit**	**Description**
Bit 1	Clear Faults	Bit 1	Axis Faulted
Bit 2	Axis Enable	Bit 2	Axis Enabled
Bit 3	Axis Disable	Bit 3	Axis Homed
Bit 4	Axis Home	Bit 4	Axis Jogging +
Bit 5	Axis Jog+	Bit 5	Axis Jogging -
Bit 6	Axis Jog -	Bit 6	Axis In-Position
Bit 7	Axis Zero Position	Bit 7	Axis In-Deceleration
Bit 8 - 15	Reserved for Internal Use	Bit 8 - 15	Reserved for Internal Use
Bit 16	Allow PLC to Set User Outputs	Bit 16	Reserved for Internal Use

5.2.3. User Output & Input Register Bits

User Output Register 4XXXX+7		User Input Register 3XXXX+7	
Bit	**Description**	**Bit**	**Description**
Bit 1	User Sink Output 8	Bit 1	Reserved for Internal Use
Bit 2	User Sink Output 7	Bit 2	Reserved for Internal Use
Bit 3	User Sink Output 6	Bit 3	Reserved for Internal Use
Bit 4	User Sink Output 5	Bit 4	Reserved for Internal Use
Bit 5	User Sink Output 4	Bit 5	Reserved for Internal Use
Bit 6	User Sink Output 3	Bit 6	Reserved for Internal Use
Bit 7	User Sink Output 2	Bit 7	Reserved for Internal Use
Bit 8	User Sink Output 1	Bit 8	Axis Fault Input
Bit 9	User Source Output 8	Bit 9	User Input 5
Bit 10	User Source Output 7	Bit 10	User Input 4
Bit 11	User Source Output 6	Bit 11	User Input 3
Bit 12	User Source Output 5	Bit 12	User Input 2
Bit 13	User Source Output 4	Bit 13	User Input 1
Bit 14	User Source Output 3	Bit 14	Axis Home Input
Bit 15	User Source Output 2	Bit 15	Axis REV Input
Bit 16	User Source Output 1	Bit 16	Axis FWD Input

The FN46 User Loadable Function Block allows for easy motion programming of the IFC 210R. Do not set control register (4XXXX+6) bits when the FN46 or a Concept IFC function block is enabled. These bits will conflict with the commands being sent to the IFC 210R by the FN46. You can, however, send read commands to the IFC 210R via registers 4XXXX+0 thru 4XXXX+5, while the control bits are being set.

Example: A 1020 command "Get Current Position in User Units" can be placed in register 4XXXX+0 and the position of the axis can be read back into register 3XXXX+1 thru 3XXXX+5. The enable and disable bits (4XXXX+6 – Bits 2, 3) should be pulsed until the enable bit (3XXXX+6 – Bit 2) turns on or off. The axis home bit (4XXXX+6 – Bit 4) can also be pulsed. The axis homed bit (3XXXX+6 – Bit 3) will turn on after completion of the homing sequence. The axis homed bit will reset on power up or when the axis home bit is set. The homing sequence is setup in the **Axis** dialog box. When the jog bits (4XXXX+6 – Bits 5, 6) are on, the axis will jog in the direction indicated by the bit. ***Note:*** The jog+ and jog- cannot be on at the same time. There are two new commands to set the jog and homing speed (2043 and 2044). The format is as follows:

5.2.4. Set Homing & Jog Speeds

Set Homing Speed		Set Jog Speed	
Register	**Description**	**Register**	**Description**
4XXXX+0	2043 Command	4XXXX+0	2044 Command
4XXXX+1	Axis	4XXXX+1	Axis
4XXXX+2	Home Speed High Word	4XXXX+2	Jog Speed High Word
4XXXX+3	Home Speed Low Word	4XXXX+3	Jog Speed Low Word
4XXXX+4	N/A	4XXXX+4	N/A
4XXXX+5	N/A	4XXXX+5	N/A

Examples of how to use the above registers and commands appear in *Appendix C.*

5.3. Using the FN46 User Loadable Function Block

As stated earlier, the FN46 loadable has nine modes of operation each selected by placing the Function # in the first node. Each mode is described in detail below.

5.3.1. Mode 0 – Get Loadable Version

Mode 0 returns the version of the loadable. *Figure 5-2* shows the Mode 0 operation of the FN46 loadable.

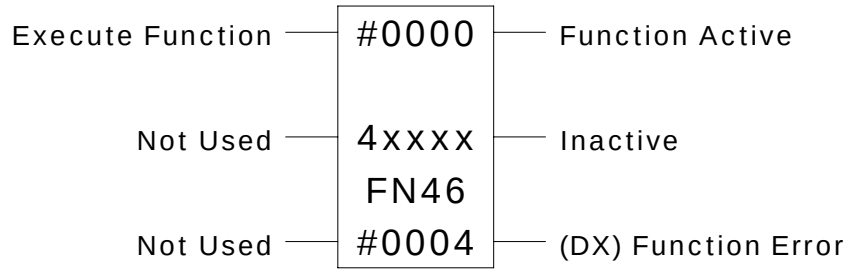


Figure 5-2: Mode 0 - Get Loadable Version Operation of FN46

The top output indicates that the IFC 210R is active. This output should always be on when input power is applied to the top input. The middle is not used.

The bottom output indicates a DX Function Fault. This fault condition indicates incorrect node information.

Mode 0 returns the loadable version in the first register specified in the FN46 loadable.

5.3.1.1. Mode 0 - PLC Read/Reserved Registers

Table 5-1 lists the read/reserved registers associated with Mode 0.

Register	Description
4XXXX+0	Loadable Version
4XXXX+1	Reserved for Internal Use
4XXXX+2	Reserved for Internal Use
4XXXX+3	Reserved for Internal Use

Table 5-1: Mode 0 - PLC Read/Reserved Registers

5.3.2. Mode 1 – Position/Speed Monitor

Mode 1 allows the PLC program to monitor the position and speed of the servo motor (in user units). This mode allows the PLC program to monitor the status of the axis such as faults, discrete input status, and software programmable limit states. In Mode 1, the PLC program can turn On/Off discrete outputs of the axis as well as set the value of each Analog Output from 0 to 4095. This analog value sets the voltage of the Analog Output to the range (i.e., 0 to 10Vdc, ±10Vdc or 0 to 5Vdc) selected in the **Axis** screen of the **Setup Module** Pull-down Menu (see *Chapter 4*). The FN46 loadable makes it easy for a PLC programmer to set up and interrogate the IFC 210R. In Mode 1, the FN46 uses a user-defined group of 19 registers for passing information to and from the IFC 210R. These 19 registers are divided into groups of write and read registers. *Figure 5-3* shows the Mode 1 operation of the FN46 loadable.

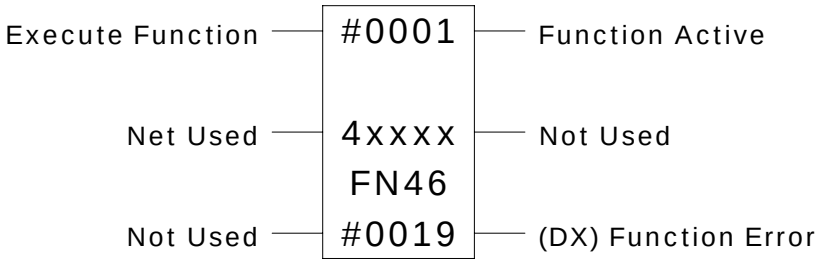


Figure 5-3: Mode 1 - Position/Speed Monitor Operation of FN46

To place the IFC 210R in Mode 1, write a 1 in the top node of the FN46 function block.

The middle node specifies the starting 4XXXX register for the 19 consecutive data registers.

Place a 19 in the bottom node to designate the number of registers being used by the FN46.

When power is applied to the top (Execute Function) input, the FN46 executes. Power should remain on the top input at all times when the FN46 is in use.

The bottom (DX Function Error) output indicates a fault condition which usually implies incorrect node information, the IFC 210R is not present, or a module communication error.

The top (Function Active) output passes power when the FN46 is active.

The FN46 loadable constantly sends analog output values to the IFC 210R and updates the PLC read registers using the first six input and first six output registers defined in the PLC Traffic-Cop. Below is a list of FN46, Mode 1 User Loadable registers.

5.3.2.1. Mode 1 - PLC Write Registers

Below in *Table 5-2* is a list of the write registers associated with Mode 1. A detailed description of each register follows.

Register	Description
4XXXX	Starting Traffic-Copped Output Register (40001 - 49999)
4XXXX+1	Starting Traffic-Copped Input Register (30001 - 39999)
4XXXX+2	Analog Output 1
4XXXX+3	Analog Output 2

Table 5-2: Mode 1 - PLC Write Registers

4XXXX ***Starting Traffic-Copped Output Register***

Enter the number of the first 4XXXX Output Register Traffic-Copped to the IFC 210R. This number must range between 0001 and 9999, and must match the register defined in the Traffic-Cop.

Example: 1234 is register 41234

4XXXX+1 ***Starting Traffic-Copped Input Register***

Enter the number of the first 3XXXX Input Register Traffic-Copped to the IFC 210R. This number must range between 0001 and 9999, and must match the register defined in the Traffic-Cop.

Example: 0334 is register 30334

4XXXX+2 ***Analog Output 1***

Write the Analog Output 1 voltage to this register. Values can range between 0 and 16383, while values above 16383 are ignored.

When = 0: -10V out
When = 16383: 10V out

Note: Only works if PID is disabled.

4XXXX+3 ***Analog Output 2***

Write the Analog Output 2 voltage to this register. Values can range between 0 and 16383, while values above 16383 are ignored.

When = 0: -10V out

When = 16383: 10V out

Note: Only works if PID is disabled or when 2-phase commutation is not selected.

5.3.2.2. Mode 1 - PLC Read/Reserved Registers

Below in *Table 5-3* is a list of the read registers associated with Mode 1. A detailed description of each register follows.

Register	Description
4XXXX+4	Axis Position High Word (user units)
4XXXX+5	Axis Position Low Word (user units)
4XXXX+6	Axis Speed (user units/sec or user units/min)
4XXXX+7	Reserved for Internal Use
4XXXX+8	Resolver Status and Limits
4XXXX+9	Module Fault Status Word
4XXXX+10	Axis Latched Faults
4XXXX+11	Axis Status
4XXXX+12 - 14	Reserved for Internal Use
4XXXX+15	Module Status Word
4XXXX+16 - 18	Reserved for Internal Use

Table 5-3: Mode 1 - PLC Read/Reserved Registers

4XXXX+4 ***Axis Position High Word***

Contains the high word of the resolver feedback position (in user units). The IFC 210R calculates a new position value every 500 uSec. Use this register with Position Low Word to form a two-register position value. Position is represented in modulo 10000.

4XXXX+5 ***Axis Position Low Word***

Contains the low word of the resolver feedback position (in user units). Use this register with Position High Word to form a two-register position value. Position is represented in modulo 10000.

Example 1: If the IFC 210R is setup for position in Inches (has two decimal places), the high word is 50 and the low word is 8051, then the actual resolver position value in user units is 5080.51 inches.

Example 2: If the IFC 210R is setup for position in Millimeters (has one decimal place), the high word is 5 and the low word is 623, then the actual resolver position value in user units is 5062.3 millimeters.

4XXXX+6 ***Axis Speed***

Current speed of the single channel resolver (user units/sec or user units/min).

4XXXX+7 ***Reserved for Internal Use***

4XXXX+8 ***Resolver Status and Limits***

Channel module status and limits data. Each status bit is described below:

Bit 1 **- *EOT Soft* –** Like the + EOT Soft except that it is triggered when the axis position is less than the end-of-travel number. By entering zero for both EPT values, the end of travels will not be active.

Bit 2 **+ *EOT Soft* –** Triggers an end-of-travel condition on the axis. This bit turns on when the position entered for +EOT Soft is exceeded in the positive direction, a bit is turned on to the PLC in the status word for the resolver channel. This bit will stay on as long as the end of travel is exceeded.

Bit 3 ***Underspeed* –** Resolver is rotating below the set under-speed value. This bit is on when the speed is less than the value entered for under-speed.

Bit 4 ***Overspeed* –** Resolver is rotating above the set over-speed value. When speed exceeds the over-speed value, a bit in the status word is turned on and remains on as long as the speed is exceeded.

Bit 5 ***Homed* –** Indicates if the axis was homed.

Bit 6 ***Moving Rev –*** This bit is active on when the resolver moves in a negative direction.

Bit 7 ***Moving Pos*** – This bit is active on when the resolver moves in a positive direction.

Bit 8 ***Reserved for Internal Use***

Bit 9 ***Software Limit Switch 0*** – Shows the current status of the resolver channel Software Limit Switch 0.

When = 0: Current resolver position is below On Position or above Off Position.

When = 1: Current resolver position is above On Position or below Off Position.

Bit 10 ***Software Limit Switch 1*** – Current status of the resolver channel Software Limit Switch 1.

Bit 11 ***Software Limit Switch 2*** – Current status of the resolver channel Software Limit Switch 2.

Bit 12 ***Software Limit Switch 3*** – Current status of the resolver channel Software Limit Switch 3.

Bit 13 ***Software Limit Switch 4*** – Current status of the resolver channel Software Limit Switch 4.

Bit 14 ***Software Limit Switch 5*** – Current status of the resolver channel Software Limit Switch 5.

Bit 15 ***Software Limit Switch 6*** – Current status of the resolver channel Software Limit Switch 6.

Bit 16 ***Software Limit Switch 7*** – Current status of the resolver channel Software Limit Switch 7.

4XXXX+9 ***Module Fault Status Word***

Contains IFC 210R fault and status information. This register is only updated when a fault occurs on the IFC 210R. Fault information bits include:

Bits 1-7 ***Reserved for Internal Use***

Bit 8 ***Setup Data Changed –*** Active setup data doesn't match Flash data. Cleared when data is saved to Flash.

Bit 9 ***Module Code Checksum Failure –*** Module code checksum failed, reload the Firmware.

Bit 10 ***Serial Checksum or Time-out –*** Error! A bad checksum was received from the serial port or a message time-out occurred. May be caused by removing the serial cable during transmission.

Bit 11 ***Serial Command Error –*** PC sent a bad command to the IFC 210R. Check cable and verify the proper com port is selected.

Bit 12 ***PLC Command Error –*** PLC sent a bad command to the IFC 210R. Check messages from the PLC.

Bit 13 ***Flash Default –*** Error! IFC 210R is using default parameters. This bit should be on when the unit is first powered-up.

Bit 14 ***Flash Memory Error –*** Should not occur. Consult factory.

Bit 15 ***Reserved for Internal Use***

Bit 16 ***PLC Error –*** Should not occur. Consult factory.

4XXXX+10 ***Axis Latched Faults***

These faults are latched once they are observed.

Bits 1-6 ***Reserved for Internal Use***

Bit 7 ***+ EOT Hardware –***

Bit 8 ***- EOT Hardware –***

Positive motion is commanded and the limit switch input is active. To clear this fault, verify the input is wired correctly and in the correct location.

Example: Accidentally issuing a Relative Reverse move instead of an Absolute or Relative Forward move could send the commanded position past the limit.

Bit 9 ***Reserved for Internal Use***

Bit 10 ***Module Fault –*** Communication with PLC failed.

Bit 11 ***Current Limit Fault*** – During PID motion control, the average current command exceeded the set limit.

Bit 12 ***-EOT Fault*** – IFC 210R detected a negative end-of-travel limit.

Bit 13 ***+EOT Fault*** – IFC 210R detected a positive end-of-travel limit.

Bit 14 ***Bad Resolver*** –

Bit 15 ***Reserved for Internal Use***

Bit 16 ***Position Error Fault*** – During PID motion control, the position commanded minus observed position exceeded the set limit.

4XXXX+11 ***Axis Status***

PLC uses this register to monitor the status of the axis while the axis is moving or at rest. The following describes the bits in this register:

Bit 1 ***Homing Off*** – If set, the axis is moving off the Home Input during a homing sequence.

Bit 2 ***Homing*** – Set to 1 when the axis receives a Home command. Resets to 0 when homing completes.

Bit 3 ***Faulted*** – Set to 1 when the axis faults. Resets to 0 when faults are cleared.

Bit 4 ***Moving Continuously –*** Set to 1 when the axis receives a command to move indefinitely at a constant velocity. Resets to 0 when the axis stops.

Bit 5 ***Reserved for Internal Use***

Bit 6 ***In-Decel*** – If set, the axis is decelerating to a stop. Resets to 0 when axis reaches the predefined In-position band.

Bit 7 ***Reserved for Internal Use***

Bit 8 ***In-Position*** – If set, the axis is within the predefined In-Position band.

Bit 9 ***Velocity Feed Forward*** – If set, the velocity feed forward gain for the axis is enabled. When enabled, the axis attempts to run with minimal or no following error. Following error is the difference between the commanded and actual position of the axis. Note that if the IFC 210R is not set for PID mode, this bit is not used.

Bit 10 ***Reverse Output Mode*** – If set, the reverse output mode of the motion PID is enabled. When enabled, the axis applies torque in the opposite direction of the force exerted by the load.

Bit 11 ***Enabled*** – If set, the motion PID for the axis is enabled. This allows the IFC 210R to control the motion of the axis.

Bit 12 ***In Negative Current Clamp*** – If set, the Analog Output Register value equals the set value of the Negative Current Clamp on the PID tuning screen in the HMI Software. ***Note:*** If operating mode is not set for PID, this bit is not used.

Bit 13 ***In Positive Current Clamp*** – If set, the Analog Output Register value equals the set value of the Positive Current Clamp on the PID tuning screen in the HMI Software. ***Note:*** If operating mode is not set for PID, this bit is not used.

Bit 14 ***Reserved for Internal Use***

Bit 15 ***Moving Minus*** – If set, the axis is moving in a negative direction. When 0, the axis is moving in the positive direction.

Bit 16 ***Moving*** – If set, the axis is moving. When 0, the axis is at rest.

4XXXX+12 - 14 ***Reserved for Internal Use***

4XXXX+15 ***Module Status Word***

Contains axis specific fault and status data. This register is only updated when a fault occurs on the IFC 210R.

4XXXX+16 - 18 ***Reserved for Internal Use***

5.3.2.3. PID Mode FN46 Operations

Operating Modes 2 through 5 of the FN46 loadable control the position and velocity of a combined system containing a servo motor and a servo drive. The IFC 210R uses a resolver to close the position or velocity loop on the drive and motor. By adjusting PID and Position Loop gains for the axis, the IFC 210R can control the drive/motor in a servo-like manner. The types of drive/motor combinations that the IFC 210R can control are: AC Vector, AC Inverter, DC SCR, DC Servo and AC Servo type drives. These drives must accept either a ±10Vdc torque command or a 0 to 10Vdc velocity reference with a Discrete Direction Input.

NOTE **The IFC 210R must be set up from the Move Pull-down Menu to control the shaft position of the servo motor. The PID gains and Position Loop gains must be tuned properly to ensure the servo motor/load is stable (not oscillating) while the system is under PID control.**

WARNING ☞**Ensure the control system can be stopped from an Emergency Stop circuit. User's must follow all federal, state, local, and plant codes for protecting humans and machinery from automatic control equipment. If the system requires End-of-Travel limits to protect the machinery, they must be wired into the end of travel limit terminals of the IFC 210R (see Figure X-XX in Appendix X). Failure to do so may cause mechanical destruction to machinery, bodily harm, or death!!! See *Chapter 4* for more information on controlling a servo motor when using the IFC 210R.**

5.3.3. Mode 2 – Homing

Mode 2 allows the PLC program to home the axis under PID control from the IFC 210R. Use extreme caution when enabling any type of motion from the IFC 210R. *Figure 5-4* shows the Mode 2 operation of the FN46 loadable.

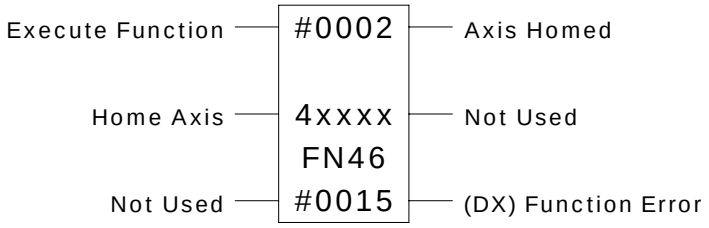


Figure 5-4: Mode 2 - Homing Operation of FN46

To place the IFC 210R in Mode 2, do the following:

0. Write a 2 in the top node of the FN46 function block.
1. The middle node specifies the starting 4XXXX (Starting Traffic-Copped Output Register) register for the 15 consecutive function block data registers. Place a 15 in the bottom node to designate the number of registers being used by the FN46.
2. Mode 2 of the function block uses 15 consecutive registers to write and read data between the PLC and the IFC 210R. Before applying power to the inputs of the FN46 Mode 2, enter data into the PLC write registers of the FN46.

When power is applied to the top input (**Execute Function**), the FN46 executes. Power should remain on the top input at all times when the Homing Function is in use.

When power is applied to the middle input (**Home Axis**), the servo motor begins moving in the direction set in register 4XXXX+2 (Axis Homing Direction – FWD or REV) at the speed set in register 4XXXX+3 (Axis Homing Speed – High Register) and 4XXXX+4 (Axis Homing Speed – Low Register). The motor continues to move until the home limit switch connected to the Discrete Input 1 is asserted to the state checked on the **Axis Setup** screen of the **Setup Module** Pull-down Menu. After the home limit switch is asserted, the axis continues to move in the home direction/speed until it reaches a Resolver Null. After the axis stops, the top output (**Axis Homed**) of the FN46 loadable turns on and the position of the axis is set to 0 or to the home offset value set in **Axis Setup**.

The bottom output (**DX Function Error**) is used to indicate a DX Function Fault. This fault condition usually implies incorrect node information, incorrect register information, the IFC 210R is not present, or a module communication error.

NOTE **The Homing Input is recognized by the loadable on a transition from low-to-high and while power is applied to the top node. Homing will not occur if power is applied to top and Home Input simultaneously.**

If power is removed from the Home Axis Input while homing, the axis will halt.

The axis will not enable and move if a fault is present on the axis.

5.3.3.1. Mode 2 - PLC Write Registers

There are eight PLC write registers associated with the FN46 Mode 2 function block, see *Table 5-4*. A detailed description of each register follows.

Register	Description
4XXXX	Starting Traffic-Copped Output Register (40001 - 49999)
4XXXX+1	Starting Traffic-Copped Input Register (30001 - 39999)
4XXXX+2	Axis Homing Direction (0 = FWD, 1 = REV)
4XXXX+3	Axis Homing Speed (High Register)
4XXXX+4	Axis Homing Speed (Low Register)
4XXXX+5	Reserved for Internal Use
4XXXX+6	Reserved for Internal Use
4XXXX+7	Reserved for Internal Use

Table 5-4: Mode 2 - PLC Write Registers

4XXXX ***Starting Traffic-Copped Output Register***

Enter the number of the first 4XXXX Output Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 1234 is register 41234

4XXXX+1 ***Starting Traffic-Copped Input Register***

Enter the number of the first 3XXXX Input Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 0334 is register 30334

4XXXX+2 ***Axis Homing Direction***

Enter a value of 0 or 1.

When = 0: Homes the axis in a FWD direction.
When = 1: Homes the axis in a REV direction.

4XXXX+3 ***Axis Homing Speed (High Register)***

Enter a whole number value (user units) to set the homing speed of the axis.

4XXXX+4 ***Axis Homing Speed (Low Register)***

Enter a fractional portion (user units) to set the homing speed of the axis.

Example: 5.1234 in/sec
4XXXX+3 = 00005
4XXXX+4 = 01234

4XXXX+5 - 7 ***Reserved for Internal Use***

5.3.3.2. Mode 2 - PLC Read/Reserved Registers

There are seven PLC read/reserved registers associated with the FN46 Mode 2 function block, see *Table 5-5*. Do not write to these registers.

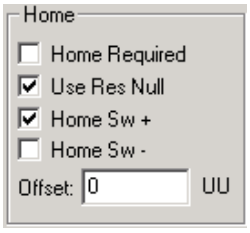
Register	Description
4XXXX+8 - 14	Reserved for Internal Use

Table 5-5: Mode 2 - PLC Read/Reserved Registers

5.3.3.3. Mode 2 - Homing Methods

Homing to Resolver Null with a Normally Open Home Switch

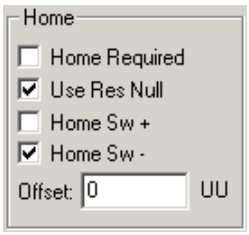
Apply this method when using a normally open home switch and you want the Resolver Null to be the home position. Select this mode in the **Axis Setup** of the **Setup Module** Pull-down Menu by setting the Use Res Null for homing and selecting Home Sw+ to home the axis using a low-to-high transition.



When homing begins, the IFC 210R looks for a transition from low-to-high of the Home Switch Input. When this transition is seen, the IFC 210R looks for the first Resolver Null to be the home position. If the home limit switch changes state back to low before a Resolver Null is seen, homing aborts. The home limit switch state must be low when the Resolver Null is seen in order for homing to complete. To ensure this occurs, your home limit switch should be on for at least one revolution of the resolver, but less than two revolutions. If you cannot ensure this, use a homing method that only uses the home switch to determine home position.

Homing to Resolver Null with a Normally Closed Home Switch

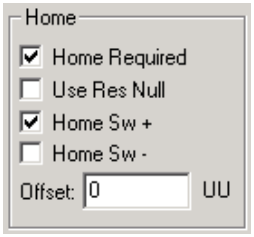
Use this method when a normally closed home limit switch is being used and you want the Resolver Null to be the home position. Select this mode in the **Axis Setup** of the **Setup Module** Pull-down Menu by setting the Use Res Null and selecting Home Sw- to home the axis using a high-to-low transition.



When homing begins, the IFC 210R looks for a transition from high-to-low of the Home Switch Input. When this transition is seen, the IFC 210R looks for the first Resolver Null to be the home position. If the home limit switch changes state back to high before a Resolver Null is seen, homing aborts. The home limit switch state must be high when the Resolver Null is seen for homing to complete. To ensure this occurs, your home limit switch should be on for at least one revolution of the resolver, but less than two revolutions. If you cannot ensure this, use a homing method that only uses the home limit switch to determine home position.

Homing to the Low-to-High Transition of the Home Switch

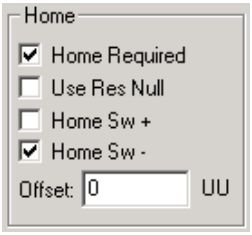
Use this method when a normally open home limit switch is used and you do not want to use a Resolver Null. Select this mode in the **Axis Setup** of the **Setup Module** Pull-down Menu by setting Home Sw- to home the axis to the home limit switch using a low-to-high transition. ***Note:*** Do not check Use Res Null for homing.



In this mode, when homing begins, the IFC 210R looks for a transition from low-to-high of the Home Switch Input. When this transition is seen, the IFC 210R sets the axis position to the home offset value.

Homing to the High-to-Low Transition of the Home Switch

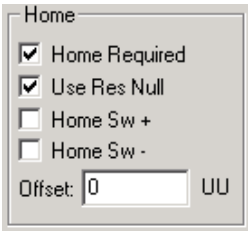
Use this method when a normally closed home limit switch is used and you do not want to use the Resolver Null. Select this mode in the **Axis Setup** of the **Setup Module** Pull-down Menu by setting Home Sw+ to home the axis to the home limit switch using a high-to-low transition. ***Note:*** Do not check Use Res Null for homing.



In this mode, when homing begins, the IFC 210R looks for a transition from high-to-low of the Home Switch Input. When this transition is seen, the IFC 210R sets the axis position to the home offset value.

Homing to Resolver Null without Using a Home Switch

Use this method when you have an absolute system and you want a Resolver Null to be the home position.



To choose this mode, select Use Res Null for homing and do not select any transition level in the HMI Software. When homing begins, the IFC 210R looks for the first Resolver Null to be the home position. No home limit switch is used.

5.3.4. Mode 3 – Single-Point Move

Mode 3 of the FN46 loadable allows the PLC to move the axis to a predefined position or an incremental distance. The PLC program sets up the move by writing the position, speed, acceleration and deceleration to predefined registers of the loadable. When the **Axis Execute Move** Input receives power, the loadable sends the data to the IFC 210R to execute the move. When the move completes, the FN46 loadable turns on its **Axis In Position Output** indicating that the move is finished and the axis in position. Use extreme caution when enabling any type of motion from the IFC 210R. *Figure 5-5* illustrates the use of the FN46 Mode 3 operation.

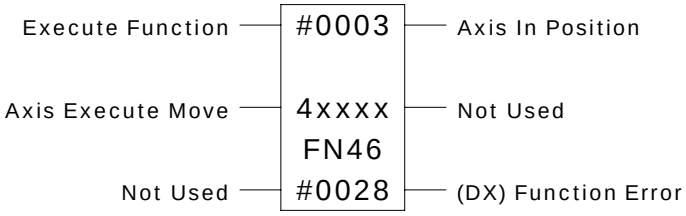


Figure 5-5: Mode 3 – Single-Point Move Operation of FN46

To place the IFC 210R in Mode 3, do the following:

1. Write a 3 in the top node of the FN46 function block.
2. The middle node specifies the starting 4XXXX (Starting Traffic-Copped Output Register) register for the 28 consecutive function block data registers. Place a 28 in the bottom node to designate the number of registers used by the loadable.
3. Mode 3 uses 28 consecutive registers to write and read data between the PLC and the IFC 210R. Before applying power to the inputs of Mode 3, enter data into the PLC write registers (see *Table 5-6*) of the FN46.

The bottom output (**DX Function Error**) indicates a DX Function Fault. This fault condition usually implies incorrect node information, incorrect register information, the IFC 210R is not present, or an IFC210R communication error.

NOTE **The Axis Execute Move Input is seen by the loadable on a transition from low-to-high and while power is applied to the top Axis node. Motion will not occur if power is applied to top Execute Function Input and middle Axis Execute Move Input simultaneously.**

If power is removed from the Axis Execute Move Input while moving, the axis halts.

The axis will not enable and move if a fault exists on the axis.

5.3.4.1. Mode 3 - PLC Write Registers

There are eighteen PLC write registers associated with the FN46 Mode 3 function block, see *Table 5-6*. A detailed description of each register follows.

Register	Description
4XXXX	Starting Traffic-Copped Output Register (40001 - 49999)
4XXXX+1	Starting Traffic-Copped Input Register (30001 - 39999)
4XXXX+2	Axis Move Type (0 = Abs, 1 = Inc Pos, 2 = Inc Neg)
4XXXX+3	Axis High Register Position (user units)
4XXXX+4	Axis Low Register Position (user units)
4XXXX+5	Axis High Register Velocity (user units)
4XXXX+6	Axis Low Register Velocity (user units)
4XXXX+7	Axis Acceleration (1 – 32767 mSec)
4XXXX+8	Axis Deceleration (1 – 32767 mSec)
4XXXX+9	Axis Acc/Dec Mode (0 = constant, 1 = S-curve)
4XXXX+10 - 17	Reserved for Internal Use

Table 5-6: Mode 3 - PLC Write Registers

4XXXX ***Starting Traffic-Copped Output Register***

Enter the number of the first 4XXXX Output Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 1234 is register 41234

4XXXX+1 ***Starting Traffic-Copped Input Register***

Enter the number of the first 3XXXX Input Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 0334 is register 30334

4XXXX+2 ***Axis Move Type***

Enter the type of move to accomplish:

When = 0: Absolute Move
When = 1: Incremental Positive Move
When = 2: Incremental Negative Move

Note: Use additional bits to disable the axis or change the axis velocity.

Bits 15,16

When = 0: Absolute Move (mask 00 binary)
When = 1: Incremental Positive Move (mask 01 binary)
When = 2: Incremental Negative Move (mask 10 binary)

Bit 14 This bit (mask 100 binary) disables the axis at the end of a move.

Bit 13 When this bit (mask 1000 binary) is active and the axis in motion, the axis velocity will update using the velocity values below in register 4XXXX+5 and 4XXXX+6. The loadable resets this bit when the velocity update occurs.

Example: To issue an Absolute move and disable the axis after a move, the value should be 4 decimals.

4XXXX+3 ***Axis Position High***

Enter a whole number value (user units) for the position. Range is 0 to 65535.

4XXXX+4 ***Axis Position Low***

Enter a fractional value (user units) for the position. Range is 0 to 9999.

4XXXX+5 ***Axis Velocity High***

Enter a whole number value (user units) for the velocity of the move.

4XXXX+6 ***Axis Velocity Low***

Enter a fractional value (user units) for the velocity of the move.

4XXXX+7 ***Axis Acceleration***

Enter the acceleration time of the move (mSec).

4XXXX+8 ***Axis Deceleration***

Enter the deceleration time of the move (mSec).

4XXXX+9 ***Axis Acc/Dec Mode***

Enter either a 0 or 1.

When = 0: Accel/Decel portions of the move are constant.

When = 1: Accel/Decel will use S-curve (1-cosine) acceleration, referred to as anti-jerk due to its tendency to smooth out bottom/top portions of the move profile.

4XXXX+10 - 17 ***Reserved for Internal Use***

5.3.4.2. Mode 3 - PLC Read/Reserved Registers

There are ten PLC read/reserved registers associated with the FN46 Mode 3 function block, see *Table 5-7*.

Register	Description
4XXXX+18 - 19	Reserved for Internal Use
4XXXX+20	Axis PID Status Register
4XXXX+21	Reserved for Internal Use
4XXXX+22	Axis Observed Position High Word (in user units)
4XXXX+23	Axis Observed Position Low Word (in user units)
4XXXX+24 - 27	Reserved for Internal Use

Table 5-7: Mode 3 - PLC Read/Reserved Registers

4XXXX+18 - 19 ***Reserved for Internal Use***

4XXXX+20 ***Axis PID Status Register***

Bit 1 ***Homing Off Input –*** Axis is homing off the input switch. Once off, it reverses direction and continues homing.

Bit 2 ***Homing –*** Axis is currently homing.

Bit 3 ***Faulted –*** Axis is currently faulted.

Bit 4 ***Moving Continuously –*** Axis is moving continuously. A homing sequence or a start motion is in progress.

Bit 5 ***Reserved for Internal Use***

Bit 6 ***Decelerating –*** Axis is decelerating.

Bit 7 ***Reserved for Internal Use***

Bit 8 ***In-Position –*** Axis is in-position or done.

Bit 9 - 14 ***Reserved for Internal Use***

Bit 15 ***Moving Negative –*** Axis is moving in a negative direction.

Bit 16 ***Moving –*** Axis is moving.

4XXXX+21 ***Reserved for Internal Use***

4XXXX+22 ***Axis Position High Word***

Contains the observed high word of the resolver position (user units).

4XXXX+23 ***Axis Position Low Word***

Contains the observed low word of the resolver position (user units).

4XXXX+24 - 27 ***Reserved for Internal Use***

5.3.4.3. Entering Data in the Loadable for a Given Move

Example: **Move axis from 10.5 to 26.75 inches at a rate of 15.34 in/sec.**

The axis must accel up to speed in 1 inch and decel to a stop in 1.5 inches using S-curve acceleration. Calculate the following and enter the data into the registers of the FN46 Mode 3 User Loadable:

Accel time = dist/0.5 * rate => 1.00/0.5 * 15.34 = 0.13038 sec
Decel time = dist/0.5 * rate => 1.50/0.5 * 15.34 = 0.19557 sec

Assume the IFC 210R is Traffic-Copped at 40001 and 30001. Enter the data into the registers as shown below:

For Absolute Move		***For Incremental Move***	
4XXXX	= 00001	4XXXX	= 00001
4XXXX+1	= 00001	4XXXX+1	= 00001
4XXXX+2	= 00000	4XXXX+2	= 00001
4XXXX+3	= 00026	4XXXX+3	= 00016
4XXXX+4	= 07500	4XXXX+4	= 02500
4XXXX+5	= 00015	4XXXX+5	= 00015
4XXXX+6	= 03400	4XXXX+6	= 03400
4XXXX+7	= 00130	4XXXX+7	= 00130
4XXXX+8	= 00196	4XXXX+8	= 00196
4XXXX+9	= 00001	4XXXX+9	= 00001

Apply power for the axis Execute Move Input.

5.3.5. Mode 4 – Sixteen-Point Move Download

Mode 4 allows the PLC to write data to the 16-point **Move Table** of the IFC 210R. The PLC program keeps an Original Data Table that stores the position, speed, acceleration and deceleration for up to 16 different positions for the axis. The PLC also keeps a Mirror Data Table that is compared with the Original Data Table. Changes to the Original Data Table cause the loadable to write the new data to the IFC 210R and then update the Mirror Data Table stored in the PLC. *Figure 5-6* illustrates the use of the FN46 Mode 4 User Loadable.

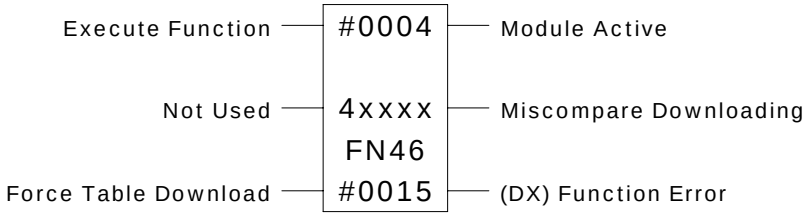


Figure 5-6: Mode 4 – Sixteen-Point Move Download Operation of FN46

To place the FN46 in Mode 4, do the following:

1. Write a 4 in the top node of the FN46.
2. The middle node specifies the starting 4XXXX (Starting Traffic-Copped Output Register) register for the 15 consecutive FN46 data registers.
3. In the bottom node write a 15 to represent the number of consecutive registers used by the loadable.

When the top input (**Execute Function**) receives power, Mode 4 starts to compare the Original Data Table with the Mirror Data Table. If any data in the Original Data Table changes, the loadable sends the new data to the IFC 210R and updates the Mirror Data Table.

When the bottom input (**Force Table Download**) receives power, the loadable forces a download of all data to the IFC 210R 16-point **Move Table**.

The top output (**Module Active**) passes power when the top Execute Function Input is powered on.

The middle output (**Miscompare Downloading**) turns on when the loadable finds a miss-compare between the Original Data Table and the Mirror Data Table.

The bottom output (**DX Function Error**) indicates a DX Function Fault. This fault condition usually implies incorrect node information, incorrect register information, the IFC 210R is not present, or an IFC 210R communication error.

The following describes the read/ write registers of the FN46 Mode 4 User Loadable:

5.3.5.1. Mode 4 - PLC Write Registers

There are five PLC write registers associated with the FN46 Mode 4 function block, see *Table 5-8*. A detailed description of each register follows.

Register	Description
4XXXX	Starting Traffic-Copped Output Register (40001 - 49999)
4XXXX+1	Starting Traffic-Copped Input Register (30001 - 39999)
4XXXX+2	Starting Register for Original Data Table of Registers
4XXXX+3	Starting Register for Mirror Data Table of Registers
4XXXX+4	Total Number of Registers in Original Data Table

Table 5-8: Mode 4 - PLC Write Registers

4XXXX ***Starting Traffic-Copped Output Register***

Enter the number of the first 4XXXX Output Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 1234 is register 41234

4XXXX+1 ***Starting Traffic-Copped Input Register***

Enter the number of the first 3XXXX Input Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 0334 is register 30334

4XXXX+2 ***Starting Register for Original Data Table of Registers***

Enter the number of the first 4XXXX Output Register of the original data table.

Example: 1100 is register 41100

4XXXX+3 ***Starting Register for Mirror Data Table of Registers***

Enter the number of the first 4XXXX Output Register of the mirrored data table.

Example: 1200 is register 41200

4XXXX+4 ***Total Number of Registers in Original Data Table***

Enter the number of registers in the original data.

5.3.5.2. Mode 4 - PLC Read/Reserved Registers

There are ten PLC read/reserved registers associated with the FN46 Mode 4, see *Table 5-9*. Do not write to these registers.

Register	Description
4XXXX+5 - 14	Reserved for Internal Use

Table 5-9: Mode 4 - PLC Read/Reserved Registers

To find the number of registers used in the Original Data Table, use the following formula:

(# points) x [2(pos regs) + 2(velocity regs) + 1(accel reg) + 1(decel reg)]

Example:

16 positions * (2+2+1+1) = 196 Original Data Table registers and 196 Mirror Data Table registers. This value is placed in the loadable register 4XXXX+4.

Table 5-10 is an example memory map of the FN46 Mode 4 User Loadable.

Adder	Description	Value
40200	Starting Traffic-Copped Read Register	00001
40201	Starting Traffic-Copped Write Register	00001
40202	Starting Register of Original Data Table	06000
40203	Starting Register of Mirror Data Table	06200
40204	Total Number of Registers in Data Table	00196

Table 5-10: Mode 4 - FN46 Example Memory Map

Table 5-11 lists the registers of the Original Data Table and Mirror Data Table used by Mode 4 for sending positions, speeds, accelerations and decelerations for the 16 different axis moves.

Original Table Adder	Mirror Table Adder	Description	Value
46000	46200	Axis Position 1 High Register	00010
46001	46201	Axis Position 1 Low Register	05000
46002	46202	Axis Position 2 High Register	00020
46003	46203	Axis Position 2 Low Register	02500
46004	46204	Axis Position 3 High Register	00030
46005	46205	Axis Position 3 Low Register	07500
46030	46230	Axis Position 16 High Register	00005
46031	46231	Axis Position 16 Low Register	05000
.	.	.	
.	.	.	
.	.	.	
46064	46264	Axis Velocity 1 High Register	00002
46065	46265	Axis Velocity 1 Low Register	05000
46066	46266	Axis Velocity 2 High Register	00004
46067	46267	Axis Velocity 2 Low Register	05000
46068	46268	Axis Velocity 3 High Register	00006
46069	46269	Axis Velocity 3 Low Register	05000
46094	46294	Axis Velocity 16 High Register	00008
46095	46295	Axis Velocity 16 Low Register	05000
.	.	.	
.	.	.	
.	.	.	
46128	46328	Axis Acceleration 1 Register	01000
46129	46329	Axis Acceleration 2 Register	01500
46130	46330	Axis Acceleration 3 Register	02000
.	.	.	
.	.	.	
46143	46343	Axis Acceleration 16 Register	01500
.	.	.	
.	.	.	
.	.	.	
46159	46359		01500
46160	46360	Axis Deceleration 1 Register	01000
46161	46361	Axis Deceleration 2 Register	01500
46162	46362	Axis Deceleration 3 Register	02000
.	.	.	
.	.	.	
.	.	.	
46175	46375	Axis Deceleration 16 Register	01500
.	.	.	
.	.	.	
.	.	.	
46191	46391		01500

Table 5-11: Original & Mirror Data Table Registers

5.3.6. Mode 5 – Execute Move from Table

Mode 5 of the FN46 allows the PLC to execute one of the sixteen different moves stored

in the IFC 210R 16-point **Move Table** for the axis. The PLC executes a move by setting one bit out of sixteen in a Move Mask register for the axis to be moved. If the axis is enabled, the IFC 210R commands the axis to move to the position corresponding to the bit selected in the Move Mask register. When the move completes, the IFC 210R sets a corresponding bit in the Move Complete Mask register to inform the PLC that the move is complete and the axis in-position. When the PLC initiates another move, the Move Complete bit is reset. *Figure 5-7* illustrates the use of the FN46 Mode 5.

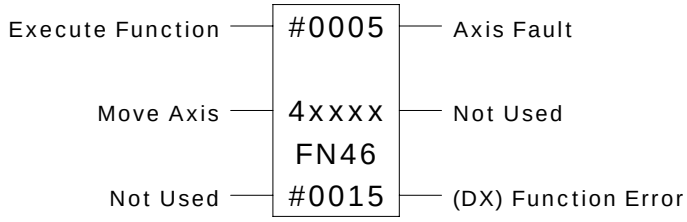


Figure 5-7: Mode 5 - Execute Move from Table Operation of FN46

To place the FN46 in Mode 5, do the following:

1. Write a 5 in the top node of the FN46.
2. The middle node specifies the starting 4XXXX (Starting Traffic-Copped Output Register) register for the 15 consecutive function block data registers.
3. Place a 15 in the bottom node to set the number of registers used by the loadable.

Before applying power to the inputs of the loadable, configure the FN46 by entering data into the PLC write registers (see Mode 5 register descriptions). Once you configure the loadable you may apply power to the inputs.

When power is applied to the top (**Execute Function**) input, the FN46 executes. Power should remain on the top input at all times when this mode is in use.

Before applying power to the middle (**Move Axis**) input, select a bit in register 4XXXX+2. Select the Axis Enable Bit 2 in register 4XXXX+4. Apply power to the middle input. The axis will move to the position stored in the IFC 210R that corresponds to the bit selected in 4XXXX+2. When the move completes, a corresponding bit in the Axis Move Complete Mask register (4XXXX+5) will be set for the axis.

If a fault occurs on the axis, the top (**Axis Fault**) output turns on. When the fault is cleared, the output turns off.

The bottom output (DX Function Error) is used to indicate a DX Function Fault. This fault condition usually implies incorrect node information, incorrect register information, the IFC 210R is not present, or an IFC 210R communication error.

NOTE ☝ **The Move Axis Input is recognized by the loadable on a transition from low-to-high and while power is applied to the top node. Motion will not occur if power is applied to top and Move Axis Input simultaneously.**

5.3.6.1. Mode 5 - PLC Write Registers

The following *Table 5-12* provides a description of the 5 write registers used by the FN46 Mode 5 User Loadable:

Register	Description
4XXXX	Starting Traffic-Copped Output Register (40001 - 49999)
4XXXX+1	Starting Traffic-Copped Input Register (30001 - 39999)
4XXXX+2	Axis Move Mask
4XXXX+3	Reserved for Internal Use
4XXXX+4	Axis Absolute/± Incremental Move, Enable Mask

Table 5-12: Mode 5 - PLC Write Registers

The following is a detailed description of the PLC write registers of the FN46 Mode 5 User Loadable:

4XXXX ***Starting Traffic-Copped Output Register***

Enter the number of the first 4XXXX Output Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 1234 is register 41234

4XXXX+1 ***Starting Traffic-Copped Input Register***

Enter the number of the first 3XXXX Input Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 0334 is register 30334

4XXXX+2 ***Axis Move Mask***

PLC uses this register to select the corresponding move from the axis **Move Table**. You can only select one bit at a time.

Example: If Bit 9 is selected in this register, the IFC 210R moves the axis to the position stored in the 9th field of the **Move Table**. The axis moves at the predefined speed, acceleration, and deceleration.

4XXXX+3 ***Reserved for Internal Use***

4XXXX+4 ***Absolute / ± Incremental Move, Enable Mask***

PLC uses this register to enable the axis and to establish an Incremental or Absolute move. Absolute moves are indicated by the absence of Bits 1 and 2. The following describes the bits in this register:

Bit 1 ***Axis Incremental Move Positive –*** If set, the axis moves a relative distance in the positive direction from its present position. If Bits 1 and 2 are zero, the axis moves to the absolute position selected by the bit in the Move Mask Register referenced from the resolver's zero position.

Bit 2 ***Axis Incremental Move Negative –*** If set, the axis moves a relative distance in the negative direction from its present position. If Bits 2 and 1 are zero, the axis moves to the absolute position selected by the bit in the Move Mask Register referenced from the resolver's zero position. Note that Bit 1 must also be set.

Bit 3 ***Axis Enable –*** If this bit is set, the axis is configured correctly, and no faults exist on the axis, the axis enables its PID to control the motion of the servo drive and servo motor.

Bit 4-16 ***Reserved for Internal Use***

5.3.6.2. Mode 5 - PLC Read/Reserved Registers

Register	Description
4XXXX+5	Axis Move Complete Mask
4XXXX+6	Reserved for Internal Use
4XXXX+7	Axis Status
4XXXX+8 - 15	Reserved for Internal Use

Table 5-13: Mode 5 - PLC Read/Reserved Registers

The following is a detailed description of the PLC read/reserved registers of the FN46 Mode 5 User Loadable:

4XXXX+5 ***Axis Move Complete Mask***

PLC uses this register to monitor when the selected move in 4XXXX+2 Axis Move Mask Register is complete.

Example: If Bit 9 in register 4XXXX+2 is set, and the IFC 210R moved the axis to the position in the 9th field, Bit 9 in this register is set (or reset) once the move completes.

4XXXX+6 ***Reserved for Internal Use***

4XXXX+7 ***Axis Status***

PLC uses this register to monitor the status of the axis while the axis is moving or at rest. The following describes the bits in this register:

Bit 1 ***Homing Off*** – If set, the axis is moving off the Home Input during a homing sequence.

Bit 2 ***Homing*** – Set to 1 when the axis receives a Home command. Resets to 0 when homing completes.

Bit 3 ***Faulted*** – Set to 1 when the axis faults. Resets to 0 when faults are cleared.

Bit 4 ***Moving Continuously –*** Set to 1 when the axis receives a command to move indefinitely at a constant velocity. Resets to 0 when the axis stops.

Bit 5 ***Reserved for Internal Use***

Bit 6 ***In-Decel*** – If set, the axis is decelerating to a stop. Resets to 0 when axis reaches the predefined In-position band.

Bit 7 ***Reserved for Internal Use***

Bit 8 ***In-Position*** – If set, the axis is within the predefined In-Position band.

Bit 9 ***Velocity Feed Forward*** – If set, the velocity feed forward gain for the axis is enabled. When enabled, the axis attempts to run with minimal or no following error. Following error is the difference between the commanded and actual position of the axis.

Bit 10 ***Reverse Output Mode*** – If set, the reverse output mode of the motion PID is enabled. When enabled, the axis applies torque in the opposite direction of the force exerted by the load.

Bit 11 ***Enabled*** – If set, the motion PID for the axis is enabled. This allows the IFC 210R to control the motion of the axis.

Bit 12 ***In Negative Current Clamp*** – If set, the Analog Output Register value equals the set value of the Negative Current Clamp on the PID tuning screen.

Bit 13 ***In Positive Current Clamp*** – If set, the Analog Output Register value equals the set value of the Positive Current Clamp on the PID tuning screen.

Bit 14 ***Reserved for Internal Use***

Bit 15 ***Moving Minus*** – If set, the axis is moving in a negative direction. When 0, the axis is moving in the positive direction.

Bit 16 ***Moving*** – If set, the axis is moving. When 0, the axis is at rest.

4XXXX+8 - 15 ***Reserved for Internal Use***

5.3.7. Mode 6 – Copy Setup Data from Module to PLC

Mode 6 of the FN46 User Loadable allows the PLC to copy axis setup data from the IFC 210R to the PLC. Using Mode 7, you can then load the data stored in the PLC to the same IFC 210R or to a new IFC 210R. This allows the PLC to initialize the IFC 210R instead of using the HMI Windows Setup Software. *Figure 5-8* illustrates the use of the FN46 Mode 6 User Loadable.

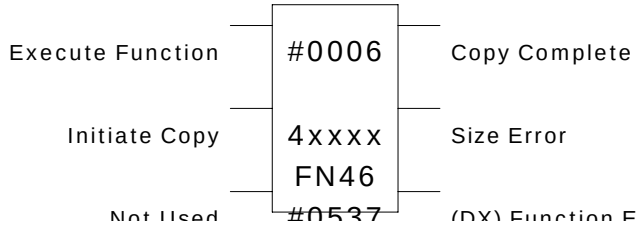


Figure 5-8: Mode 6 – Copy Setup Data Operation of FN46

To place the FN46 User Loadable in Mode 6, do the following:

1. Write a 6 in the top node of the FN46.
2. The middle node specifies the starting 4XXXX (Starting Traffic-Copped Output Register) register for the 538 consecutive function block data registers.
3. Place a 538 in the bottom node to designate the number of PLC registers used by the loadable. Before applying power to the inputs of the FN46 Mode 6, you must configure the loadable by entering data into the PLC Mode 6 Write Registers (see *Table 5-14*). Once configured, you may power the inputs.

When power is applied to the top (**Execute Function**) input, the function block executes. Power should remain on the top input at all times when Mode 6 is in use.

When power is applied to the middle (**Initiate Copy**) input, the FN46 copies the setup data from the IFC 210R to the PLC Write Registers. Once this process completes, the top output becomes active.

The bottom node of 538 (number of registers necessary for Mode 6) is valid for Firmware Version 1.00. If later versions of Firmware require additional registers, a Size Error may occur on the middle (**Size Error**) output. In this case, the user can determine the correct value for this node by reading the register at the base register plus 9.

The bottom (**DX Function Error**) output indicates a fault condition. This fault condition usually implies incorrect node information, incorrect register information, the IFC 210R is not present, or an IFC 210R communication error.

NOTE **The Initiate Copy Input is recognized by the loadable on a transition from low-to-high and while power is applied to the top node. Copying will not occur if power is applied to top Execute Function Input and Initiate Copy Input simultaneously.**

5.3.7.1. Mode 6 - PLC Write Registers

The following *Table 5-14* provides a description of the registers used by the FN46 Mode 6:

Register	Description
4XXXX	Starting Traffic-Copped Output Register (40001 - 49999)
4XXXX+1	Starting Traffic-Copped Input Register (30001 - 39999)

Table 5-14: Mode 6 - PLC Write Registers

The following is a detailed description of the PLC write registers of the FN46 Mode 6 User Loadable:

4XXXX ***Starting Traffic-Copped Output Register***

Enter the number of the first 4XXXX Output Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999 and must match the register defined in the Traffic-Cop.

Example: 1234 is register 41234

4XXXX+1 ***Starting Traffic-Copped Input Register***

Enter the number of the first 3XXXX Input Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999 and must match the register defined in the Traffic-Cop.

Example: 0334 is register 30334

5.3.7.2. Mode 6 - PLC Read/Reserved Registers

The following *Table 5-15* provides a description of the read/reserved registers used by the FN46 Mode 7 User Loadable: Why not show 538?

Register	Description
4XXXX+2 - 8	Reserved for Internal Use
4XXXX+9	Number Registers Required
4XXXX+10	Start of Setup Data
.	.
.	.
.	.
4XXXX+537	End of Setup Data

Table 5-15: Mode 6 - PLC Read/Reserved Registers

The following is a detailed description of the PLC read registers of the FN46 Mode 6 User Loadable:

4XXXX+2 - 8 ***Reserved for Internal Use***

4XXXX+9 ***Number Registers Required***

Total registers required by Function 6. The value will be 538 for Firmware Version 1.00. Later Firmware versions may require addition registers. Use this value to adjust the bottom node of the FN46, if necessary. The bottom node should be equal to this value plus 10.

4XXXX+10 - 537 ***Contains the Setup Data***

5.3.8. Mode 7 – Copy Setup Data from the PLC to the Module

Mode 7 of the FN46 allows the PLC to copy the axis setup data saved using Mode 6 of the loadable (from PLC to IFC 210R). This allows the PLC to initialize the IFC 210R without using the HMI. *Figure 5-9* illustrates the use of the FN46 Mode 7.

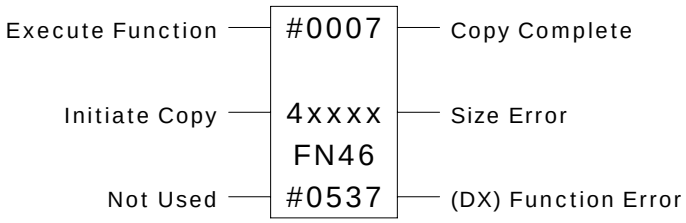


Figure 5-9: Mode 7 – Copy Setup Data Operation of FN46

To place the FN46 in Mode 7, do the following:

1. Write a 7 in the top node of the FN46.
2. The middle node specifies the starting 4XXXX (Traffic-Copped Output Register) register for the 538 consecutive FN46 data registers. In most cases, this register is the same one used in the middle node of Mode 6, used to save the data.
3. Place a 538 in the bottom node to designate the number of registers used by the loadable.

Before applying power to the inputs of Mode 7, configure the loadable by entering data into the PLC write registers. See the Mode 6 register descriptions. After you configure the loadable, you may apply power to its inputs.

When power is applied to the top (**Execute Function**) input, the FN46 executes. Power should remain on the top input at all times when this mode is in use.

When power is applied to the middle (**Initiate Copy**) input, the function proceeds to copy the setup data from the IFC 210R to the PLC write registers. Once the process completes, the top (**Copy Complete**) output becomes active.

Note: The copy process starts when the middle Initiate Copy Input goes active after being inactive. The middle input must stay active until the process completes.

The bottom node of 538 (number of registers necessary for Mode 7) is valid for Firmware Version 1.00. If later versions of Firmware require additional registers, a Size Error may occur on the middle (**Size Error**) output. In this case, use Mode 6 to determine the correct value for this node.

Size Error may also occur if the data size saved in the PLC does not match the data size in the Firmware. This may be a result of incompatible Firmware Versions or corrupted data in the PLC.

The bottom (**DX Function Error**) output indicates a DX Function Fault. This fault condition usually implies incorrect node information, incorrect register information, the IFC 210R is not present, or an IFC 210R communication error.

NOTE **The Initiate Copy Input is recognized by the loadable on a transition from low-to-high and while power is applied to the top node. Copying will not occur if power is applied to top Execute Function Input and Initiate middle Copy Input simultaneously.**

5.3.8.1. Mode 7 - PLC Write Registers

The following *Table 5-16* provides a description of the two write registers used by the FN46 Mode 7:

Register	Description
4XXXX	Starting Traffic-Copped Output Register (40001 - 49999)
4XXXX+1	Starting Traffic-Copped Input Register (30001 - 39999)

Table 5-16: Mode 7 - PLC Write Registers

4XXXX ***Starting Traffic-Copped Output Register***

Enter the number of the first 4XXXX Output Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 1234 is register 41234

4XXXX+1 ***Starting Traffic-Copped Input Register***

Enter the number of the first 3XXXX Input Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 0334 is register 30334

5.3.8.2. Mode 7 - PLC Read/Reserved Registers

The following *Table 5-17* provides a description of the read/reserved registers used by the FN46 Mode 7 User Loadable:

Register	Description
4XXXX+2 - 9	Reserved for Internal Use
4XXXX+10	Start of Setup Data
.	.
.	.
.	.
4XXXX+537	End of Setup Data

Table 5-17: Mode 7 - PLC Read/Reserved Registers

5.3.9. Mode 8 – General Low-level Commands

Mode 8 of the FN46 User Loadable allows the PLC to execute a low level command on the IFC 210R. The command is triggered on a rising edge on the execute input of the loadable. The Command Complete output node is activated upon completion of the command. *Figure 5-9* illustrates the use of the FN46 Mode 8 User Loadable.

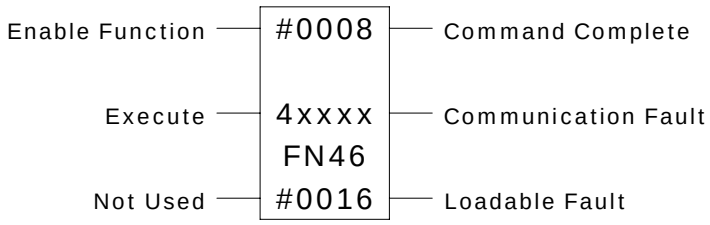


Figure 5-10: Mode 8 – Execute Low-level Command of FN46

To place the FN46 in Mode 8, do the following:

1. Write an 8 in the top node of the FN46.
2. The middle node specifies the starting 4XXXX register for the 15 consecutive FN46 data registers.
3. Place a 16 in the bottom node to set the number of registers used by the loadable.

Before applying power to the inputs of the FN46 Mode 5, they must be configured by entering data into the PLC write registers. See the FN46 Mode 8 register descriptions on the following page. After the loadable is configured, power can be applied to its inputs.

When power is applied to the top (**Enable Function**) input, the FN46 begins to execute. Power should remain on the top input at all times when this mode is in use.

When power is applied to the middle (**Execute**) input, the command with its data will be sent to the IFC 210R. Then, the loadable will either enable the Command Complete Output or the IFC 210R will process a Communication Fault Output.

The top (**Command Complete**) output indicated that the command has been successfully processed.

The middle (**Communication Fault**) output indicates a communication fault with the IFC 210R. Either the module is not present or the command is not properly formatted.

The bottom (**DX Function Error**) output is used to indicate a DX function fault. This fault condition usually indicates incorrect node information or incorrect register information.

NOTE ☝ The Execute Command Inputs are recognized by the loadable on a transition from low-to-high and while power is applied to the top node.

Register	Description
4XXXX	Starting Traffic-copped Output Register (40001-49999)
4XXXX+1	Starting Traffic-copped Input Register (30001-39999)
4XXXX+2	Command Word
4XXXX+3	Command Data Word 1
4XXXX+4	Command Data Word 2
4XXXX+5	Command Data Word 3
4XXXX+6	Command Data Word 4
4XXXX+7	Command Data Word 5

Table 5-18: Mode 8 - PLC Write Registers

4XXXX ***Starting Traffic-Copped Output Register***

Enter the number of the first 4XXXX Output Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 1234 is register 41234

4XXXX+1 ***Starting Traffic-Copped Input Register***

Enter the number of the first 3XXXX Input Register Traffic-Copped to the IFC 210R. This number must range from 0001 to 9999, and must match the register defined in the Traffic-Cop.

Example: 0334 is register 30334

4XXXX+2 ***Command Word***

Specifies the command.

Example: 1003 is the command to get the firmware revision level of the IFC 210R.

4XXXX+3 ***Optional Command Data Word 1***

4XXXX+4 ***Optional Command Data Word 2***

4XXXX+5 ***Optional Command Data Word 3***

4XXXX+6 ***Optional Command Data Word 4***

4XXXX+7 ***Optional Command Data Word 5***

Register	Description
4XXXX+8	Command Response
4XXXX+9	Response Data Word 1
4XXXX+10	Response Data Word 2
4XXXX+11	Response Data Word 3
4XXXX+12	Response Data Word 4
4XXXX+13	Response Data Word 5
4XXXX+14	Reserved for Internal Use
4XXXX+15	Reserved for Internal Use

Table 5-18: Mode 8 - PLC Read/Reserved Registers

4XXXX+8 ***Command Response***

4XXXX+9 ***Optional Response Data Word 1***

4XXXX+10 ***Optional Response Data Word 2***

4XXXX+11 ***Optional Response Data Word 3***

4XXXX+12 ***Optional Response Data Word 4***

4XXXX+13 ***Optional Response Data Word 5***

4XXXX+14 - 15 ***Reserved for Internal Use***

In this Chapter you will learn about:

Troubleshooting Procedures

Diagnostic LEDs

Setup Software Diagnostics

PLC Diagnostics

6.1. Troubleshooting Procedures

The information in this chapter will help you isolate and resolve system hardware and software problems. When your system does not function properly (or as you expect it to operate), the first thing that you must do is identify and isolate the problem. When you have accomplished this, you can effectively begin to resolve the problem.

The first step to troubleshooting is to isolate each system component and ensure that each component functions properly when it runs independently. You may have to dismantle your system and rebuild it piece-by-piece in order to detect the problem. If you have additional components available, you may want to try replacing them with existing components or components that are working in another system. You should also try removing features until the component is running in its most basic mode.

Determine if the problem is mechanical, hardware or software-related. Try to recreate or repeat the problem. Do not attempt to make quick rationalizations about the problem. Random events may appear to be related, but they are not necessarily contributing factors to the problem. You must carefully investigate and decipher the events that occur leading up to the problem.

You could be experiencing more than one problem. Try to isolate and solve one problem at a time. Document all testing and problem isolation procedures for review with a technician at a later time. When you feel that you have exhausted all possibilities and the problem still exists, call your local distributor or I²T Technical Support at (412) 828-1200. Please have the following information available when you call:

- Product Part Numbers (P/N)
- Product Serial Number (SN)
- Detailed Description of the Problem
- Description of the Application
- Firmware Version
- HMI Windows Setup Software Version (see **Help Topics** Menu in *Chapter 4*)
- Loadable Version (see Mode 0 in *Chapter 5*)

6.2. Diagnostic LEDs

A diagnostic LED array is mounted on the circuit board directly above the terminal connections (see *Figure 6-1*) at the front of the IFC 210R. This array consists of 10 LEDs: five in the top row and five in the bottom row. When the IFC 210R Resolver Based Servo Control Module is configured into the I/O Network and the Momentum PLC is in the RUN mode, the 3rd LED in the Top Row illuminates Green (active). The system is capable of displaying more than one fault at any time (multiple LEDs light). *Table 6-1* summarizes these LEDs on the IFC 210R.

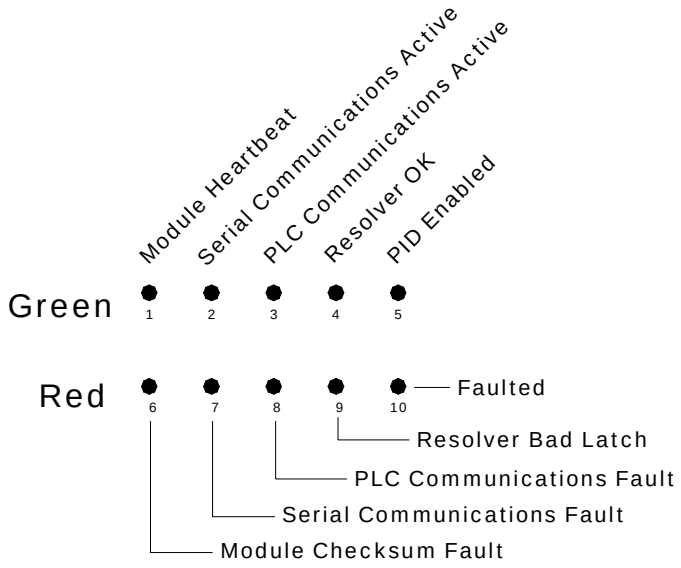


Figure 6-1: Diagnostic LED Array

LED	Description	LED	Description
Axis – Module Status/Fault LEDs (Top Row - Green)		***Module Status/Fault LEDs (Bottom Row - Red)***	
General Module Information			
1	Module Heartbeat	6	Module Checksum Fault
2	Serial Communications Active	7	Serial Communications Fault
3	PLC Communications Active	8	PLC Communications Fault
Axis Specific Information			
4	Resolver OK	9	Resolver Bad Latch
5	PID Enabled	10	Faulted

Table 6-1: Module Status and Fault LEDs

6.2.1. Module Status and Fault LEDs

The following describes the Status and Fault LEDs as they appear on the IFC 210R beginning with the Top Row from left to right (1-10).

6.2.1.1. Module Heartbeat (LED 1)

This status LED continuously blinks at a steady rate when the IFC 210R is functioning properly.

6.2.1.2. Serial Communications Active (LED 2)

This status LED blinks when there is communication between the User's PC and the IFC 210R Serial Setup Port.

6.2.1.3. PLC Communications Active (LED 3)

This status LED is on while the Momentum PLC issues commands to the IFC 210R Resolver Based Servo Control Module.

6.2.1.4. Resolver OK (LED 4)

The resolver is calibrated and working.

6.2.1.5. PID Enabled (LED 5)

The servo is enabled.

6.2.1.6. Module Checksum Fault (LED 6))

A code checksum fault was detected. Download the firmware again to clear this fault.

6.2.1.7. Serial Communications Fault (LED 7)

The user issued a bad command or a faulty cable.

6.2.1.8. PLC Communications Fault (LED 8)

The user issued a bad command or the PLC is faulty.

6.2.1.9. Resolver Bad Latch (LED 9)

An error was observed in the resolver input. Check the resolver cables.

6.2.1.10. Faulted (LED 10)

This LED is on when any number of faults has occurred on the axis. For specific errors, check the HMI fault screen.

6.3. PLC Diagnostics

User's may perform module diagnostics in one of two ways. First, use the fault register information returned to the PLC from the IFC 210R. This information contains four separate fault registers with bits defined for specific faults. The second approach is to perform diagnostics using the HMI Windows Setup Software to look at fault information. This section describes both methods.

6.3.1. Using PLC Fault/Status Registers for Diagnostics

With the **Get Fault & Status Codes** command (1001) you may use the PLC to perform fault diagnostics. To obtain the fault/status information, place a 1001 in the first register that is Traffic-Copped to the IFC 210R. To read the IFC 210R faults/status, place a 0 in the second register. To clear module faults, place a 1 in the second register. The IFC 210R returns faults and status of the IFC 210R in four input registers.

Output Register	Description	Value	Input Register	Description
4XXXX	Command	1001	3XXXX	Echo
4XXXX+1	Reset Faults	1 or 0	3XXXX+1	Module Status and Faults
4XXXX+2	Reserved for Internal Use		3XXXX+2	Module Digital Inputs
4XXXX+3	Reserved for Internal Use		3XXXX+3	Fault Mask
4XXXX+4	Reserved for Internal Use		3XXXX+4	Reserved for Internal Use
4XXXX+5	Reserved for Internal Use		3XXXX+5	Reserved for Internal Use

Table 6-2: Fault and Status Registers

The following describes the fault and status registers along with details about the fault and status bits in each register:

3XXXX ***Echo***

3XXXX+1 ***Module Status and Faults***

The IFC 210R returns status and fault information by setting bits in this register. The following describes these bits:

Bits 1-7 ***Reserved for Internal Use***

Bit 8 ***Setup Not Saved to Flash*** – Changes to the IFC 210R setup were not saved to Flash Memory.

Bit 9 ***Code Checksum Failure*** – Code in the IFC 210R Firmware is corrupt. Call I²T or download the latest Firmware to the module.

Bit 10 ***Serial Checksum or Timeout Error*** – CRC checksum or timeout occurred on the IFC 210R Serial Port. Verify the serial cable is connected properly or that there is no high voltage noise generating components near the serial cable.

Bit 11 ***Serial Command Error*** – PC, connected to IFC 210R Serial Port, sent an erroneous command or bad data within a command to the IFC 210R.

Bit 12 ***PLC Command Error*** – PLC sent an erroneous command or bad data within a command to the

IFC 210R. Check PLC logic for bad module commands, and clear this fault.

Bit 13 ***Flash Memory Default*** – IFC 210R is operating with the power up default data.

Bit 14 ***Flash Memory Fault*** – IFC 210R has trouble reading or writing to Flash Memory. Consult I²T if you cannot clear this fault.

Bit 15 ***Reserved for Internal Use***

Bit 16 ***PLC Error*** – Communication failure between the PLC and IFC 210R.

3XXXX+2 ***Module Digital Inputs***

The IFC 210R returns the state of the module limits in this register. The following describes the bits in this register.

Bits 1-7 ***Reserved for Internal Use***

Bit 8 ***Fault Input*** – If set, the axis fault input is on.

Bit 9 ***User Input 5*** – Current state of input 5.

Bit 10 ***User Input 4*** – Current state of input 4.

Bit 11 ***User Input 3*** – Current state of input 3.

Bit 12 ***User Input 2*** – Current state of input 2.

Bit 13 ***User Input 1*** – Current state of input 1.

Bit 14 ***Home Input*** – If this occurs, the axis Home Limit Switch activates.

Bit 15 ***REV Input*** – If this occurs, the axis REV Soft EOT Limit Switch activates, the axis disables and no motion is allowed in the REV direction. Re-enable the axis and jog off in the FWD direction.

Bit 16 ***FWD Input*** – If this occurs, the axis FWD Soft EOT Limit Switch activates, the axis disables and no motion is allowed in the FWD direction. Re-enable the axis and jog off in the REV direction.

3XXXX+3 ***Fault Mask***

The IFC 210R returns axis faults in this register. The following describes the bits in this register:

Bits 1-5 ***Reserved for Internal Use***

Bit 6 ***Fault Input*** – If set, the Fault Limit Switch activates.

Bit 7 ***REV Hardware EOT*** – REV Hardware EOT Limit Switch activates, the axis disables and no motion is allowed in the REV direction. Re-enable the axis and jog off in the FWD direction.

Bit 8 ***FWD Hardware EOT*** – FWD Hardware EOT Limit Switch activates, the axis disables and no motion is allowed in the FWD direction. Re-enable the axis and jog off in the REV direction.

Bit 9 ***Reserved for Internal Use***

Bit 10 ***Module Fault*** – IFC 210R is not I/O Mapped or the PLC is not in the RUN state. I/O Map the IFC 210R as an AEC920-00 high-speed counter module.

Bit 11 ***Current Limit*** – Current limit exceeded. Set by the percentage and time setup in the **Tune** dialog box of the **Tools** Pull-down Menu.

Bit 12 ***REV Software EOT*** – Servo motor position exceeds the Soft EOT- value set in the **Axis Setup** dialog box. When this occurs, the axis disables. Re-enable the axis and jog off the Soft EOT in the FWD direction.

Bit 13 ***FWD Software EOT*** – Servo motor position exceeds the Soft EOT+ value set in the **Axis Setup** dialog box. When this occurs, the axis disables. Re-enable the axis and jog off the Soft EOT+ in the REV direction.

Bit 14 ***Reserved for Internal Use***

Bit 15 ***Reserved for Internal Use***

Bit 16 ***Position Error –*** Actual position minus commanded position exceeds that set in the **Tune** dialog box of the **Tools** Pull-down Menu.

4XXXX ***Get Fault & Status Codes Command***

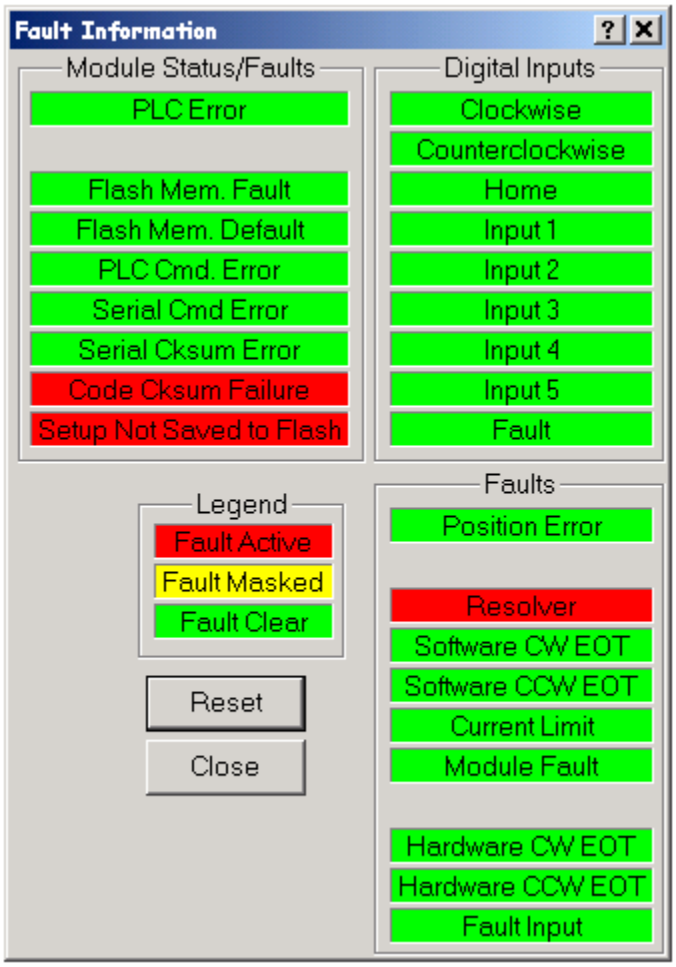
A 1001 command was issued. This command will return the current fault status.

4XXXX+1 ***Reset Faults***

To clear faults on the IFC 210R, pulse the specific Control & Status Register Bits described in *Section 5.2.2*. If faults can't be cleared, check physical setup (i.e., limit switches, etc.)

6.4. Using Setup Software for Diagnostics

You may use the HMI Windows Setup Software to perform module diagnostics. Connect your PC to the serial setup port on the module and start the Windows Setup Software by clicking on the I²T HMI icon. Once the software loads, select **Tools** from the Main Menu then **Faults**.



This screen displays fault and input information for the axis. When a fault occurs or a Limit Switch Input is true, the box associated with the condition appears in red. If able, the **Reset** button clears the fault. The **Close** button allows you to close the dialog box. The following is a description of the faults that appear in the dialog box above:

6.4.1. Module Fault Status Indicators

The following describes the faults that can occur on the IFC 210R.

6.4.1.1. PLC Error

PROBLEM/CAUSE	SOLUTION
IFC 210R is not configured in the Momentum I/O Network by the PLC or the PLC is not in a RUN state. Cause may be hardware failure.	Verify the IFC 210R is configured in the Momentum I/O Network and ensure the PLC is in the RUN state.

6.4.1.2. Flash Memory Fault

PROBLEM/CAUSE	SOLUTION
IFC 210R failure on flash device.	Contact your I²T distributor.

6.4.1.3. Flash Memory Default

PROBLEM/CAUSE	SOLUTION
IFC 210R is in a default state. ***Note:*** Modules are shipped in this state.	User must configure the IFC 210R to clear this status. ***Note:*** This is a good indication of an un-programmed module.

6.4.1.4. PLC Command Error

PROBLEM/CAUSE	SOLUTION
PLC issued an invalid or unknown command to the IFC 210R. Registers designated for the IFC 210R are being un-initialized or used for other purposes.	Ensure valid module command data is present in these registers and no other logic is writing to the I/O Mapped Registers. This fault remains latched until cleared by the 1001 “Get Fault/Status Codes” command and will not prevent operation while active.

6.4.1.5. Serial Command Error

PROBLEM/CAUSE	SOLUTION
PC issued an invalid or unknown command to the IFC 210R via the serial port. Cause may be communication failure due to faulty cables or from removing the serial connection while communicating.	Ensure serial cable is in good condition and well secured to IFC 210R and PC. ***Note:*** This fault remains latched until cleared by the 1001 command and will not prevent operation while active. ***Note:*** If communicating at higher baud rates and this error frequently occurs, try choosing a lower baud rate.

6.4.1.6. Serial Checksum Error

PROBLEM/CAUSE	SOLUTION
IFC 210R received corrupt data from the PC via the serial port. May be caused by communication failures due to faulty cables or by removing the serial connection while communicating.	Ensure serial cable is in good condition and well secured to IFC 210R and PC. ***Note:*** This fault remains latched until cleared by the 1001 command and will not prevent operation while active. ***Note:*** If communicating at higher baud rates and this error frequently occurs, try choosing a lower baud rate.

6.4.1.7. Code Checksum Failure

PROBLEM/CAUSE	SOLUTION
Failure on startup self check of Firmware code.	Re-download Firmware and Setup to the IFC 210R. If this re-occurs, contact your I²T distributor.

6.4.1.8. Setup Not Saved to Flash

PROBLEM/CAUSE	SOLUTION
When active, the user has modified module settings that were not stored in Flash Memory.	Indicator may be cleared if user sends the **Copy Setup to Flash** command from the **Comm** Pull-down Menu. If this is active, any changes to the setup since the last power-up or save will be lost when the IFC 210R is reset.

6.4.2. Digital Inputs

6.4.2.1. Forward

When this occurs, the FWD EOT Limit Switch activates, the axis disables, and no FWD motion is allowed. Re-enable the axis and jog off in REV direction.

6.4.2.2. Reverse

When this occurs, the REV EOT Limit Switch activates, the axis disables, and no REV motion is allowed. Re-enable the axis and jog off in the FWD direction.

6.4.2.3. Home

When this input occurs, the Home Limit Switch activates.

6.4.2.4. Fault

When this input occurs, the Fault Limit Switch activates.

6.4.3. Fault Status

6.4.3.1. Position Error

Occurs when the actual position minus the commanded position (position error) is exceeded by the axis. Users may increase the position error value (in the **Tune** dialog box under the **Tools** Pull-down Menu) or use longer accel ramps and slower speeds. This could indicate that the servo motor and the servo drive are not properly sized for the application.

6.4.3.2. Software FWD EOT

Occurs when the servo motor position exceeds the FWD Soft EOT+ value set in the **Axis Setup** dialog box of the **Setup Module** Pull-down Menu. When this fault is true, the axis disables. Re-enable the axis and jog off in the REV direction. Verify your limit is a reasonable value and/or the commanded move was issued correctly.

For Example: Accidentally issuing an Incremental Forward move instead of an Absolute or Incremental Reverse move could send the commanded position past the limit.

6.4.3.3. Software REV EOT

Occurs when the servo motor position exceeds the FWD Soft EOT- value set in the **Axis Setup** dialog box of the **Setup Module** Pull-down Menu. When this fault is true, the axis disables. Re-enable the axis and jog off in the FWD direction. Verify your limit is a reasonable value and/or the commanded move was issued correctly.

For Example: Accidentally issuing an Incremental Reverse move instead of an Absolute or Incremental Forward move could send the commanded position past the limit.

6.4.3.4. Current Limit

This fault occurs when the current limit value in the **Tune** dialog box (in the **Tools** Pull-down Menu) exceeds the current limit time also set in **Tune**.

6.4.3.5. Module Fault

This fault occurs if the IFC 210R was not configured into the Momentum I/O Network or the PLC is not in the RUN state. To correct this fault, verify the module is configured correctly and ensure the PLC is in the RUN state. The IFC 210R uses 8 input and 8 output registers.

6.4.3.6. Hardware FWD EOT

This fault occurs when positive motion is commanded and the Limit Switch Input is active. When this occurs, the FWD Hardware EOT Limit Switch activates, the axis disables, and no motion is allowed in the FWD direction. To clear this fault, verify the input is wired correctly and in the correct location. Verify your limit is a reasonable value and/or the commanded move was issued correctly.

For Example: Accidentally issuing an Incremental Forward move instead of an Absolute or Incremental Reverse move could send the commanded position past the limit.

6.4.3.7. Hardware REV EOT

This fault occurs when negative motion is commanded and the Limit Switch Input is active. When this occurs, the REV Hardware EOT Limit Switch activates, the axis disables, and no motion is allowed in the REV direction. To clear this fault, verify the input is wired correctly and in the correct location. Verify your limit is a reasonable value and/or the commanded move was issued correctly.

For Example: Accidentally issuing an Incremental Reverse move instead of an Absolute or Incremental Forward move could send the commanded position past the limit.

6.4.3.8. Fault Input

When this input occurs, the Fault Limit Switch activates. To clear this fault, determine the source of the fault and correct it. If the Fault Input is not being used, mask the fault or jumper the input wiring so that the signal is inactive.

In this Chapter you will learn about:

Application Calculations

A.1. Application Calculations

This section describes how to calculate user units for your application. There are some limitations to the user unit number because of the way the PLC stores numbers. This section will help you select a user unit value that gives you the resolution that you need and shows you how to calculate the maximum number of revolutions that the resolver travels before a rollover occurs.

Position values are always stored in two PLC registers using Modulo 10,000 format. The following are some examples of how numbers are stored in the PLC using this format.

Number	PLC High Register	PLC Low Register
0583	00000	00583
10,020	00001	00020
125,933	00012	05933
17,592,015	01759	02015
107,921,882	10792	01882

The resultant number is obtained by using the following formula.

Position = (PLC High Register * 10000) + PLC Low Register

The low register is always 9999 or less and the high register any number from 0 to 65535. Using Modulo 10,000 format, the largest number that can be shown is 655,359,999. This number represents the largest number of position counts that can be sent to the PLC by the IFC 210R. Keep this in mind when setting user units to measure position over long distances.

User units are entered in counts/rev of the resolver via the HMI Windows Setup Software. Thus, entering a value of 0.0001 returns 1 count/resolver rev in the low register. A value of 0.0010 returns 10 counts/resolver rev in the low register. A set value of 1.0000 returns 10,000 counts/resolver rev in the low register or 1 count/resolver rev in the high register. The maximum resolver output is 4,096 counts/rev, limiting the resolution as you enter larger user unit values. The maximum number of revs that the resolver turns without rolling over is 65,535/user units, with a maximum number of 1,047,363 revs in all cases. Given the above example, if user units are set to 1.0000, the maximum number of resolver revs is 65,535/1.0000 or 65,535. If you set user units to 0.0010, a maximum number of resolver revs is 65,535/0.0010 or 65,535,000.

Appendix A _____ *IFC 210R CALCULATING USER UNITS*

In most applications, the user configures the IFC 210R to rollover at a specified number, eliminating concern for the maximum number of resolver revs. The only application where rollover is a concern is on Totalizer applications, where the resolver measures position over a long distance. The maximum number of resolver revs is 1,047,363. This number may be reduced depending on the user units that you use.

The following table shows the maximum number of revs for different user unit values.

User Units	Counts/Rev	Resolver Position	PLC High Register	PLC Low Register	Max. No. (Revs.)	Max. Posn. Value
0.0010	10	2,000 (200 revs)	00000	02000	1,047,363	10,473,630
0.0200	200	2,000 (10 revs)	0000	02000	1,047,363	10,473,630
0.500	5000	2,000 (0.4 revs)	0000	02000	131,070	655,350,000
1.2500	1250	2,000 (0.16 revs)	0000	02000	52,428	655,350,000
360.0000	3600000	2,000 (0.00055 revs)	0000	02000	182	655,350,000

NOTE ☝ As larger user units are entered, the counts/rev increase, but the actual resolution of the system remains limited to 4,096 counts/rev. For example, using user units of 1.2500, the position reported back to the PLC would increment 3 counts for every resolver count.

The following are some real-world examples of setting user units.

A.1.1. Setting User Units – Drum Position Example

A servo motor is mounted on a drum with a 1 to 1 ratio and you want to report position back to the PLC in hundredths of a degree of drum rotation.

Your user units would be 3.6000, giving you 36,000 counts/drum rev. The rollover value would be set to 3.6000 to allow the position to rollover on each rev of the drum. The following values are returned in the PLC position registers.

Drum Position	PLC High Register	PLC Low Register
45 degrees	00000	04500
90 degrees	00000	09000
270 degrees	00002	07000
359 degrees	00003	05900

If you did not use a rollover value, the maximum number of drum revs before a rollover would occur is 65,535/3.6 or 18,204.

A.1.2. Setting User Units – Steel Position Example

A servo motor is mounted on a 12" circumference wheel that measures the length of a strip of steel and you want a resolution of 0.1 inches reported back to the PLC.

Your user units would be 0.0120, giving you 120 counts/wheel rev. It is unnecessary to use a rollover value, because you want to measure the maximum length of steel. The following values are returned in the PLC position registers.

Steel Position	PLC High Register	PLC Low Register
10.5 in (0.875 ft)	0000	00105
65.2 in (5.4 ft)	0000	00652
190.8 in (15.9 ft)	0000	01908
20054.3 in (1671.2 ft)	0000	00543

The maximum number of feet that can be measured using this resolution is 1,047,363 inches.

A.1.3. Setting User Units – Ball Screw Position Example

A servo motor is mounted on a ball screw with a pitch of 8 revs/inch and you want a resolution of 0.0001 inches reported back to the PLC.

Your user units would be 0.1250, giving you 1,250 counts/rev or 10,000 counts/inch of travel. You would not use a rollover value because your ball screw has a limited length of travel. The following values are returned in the PLC position registers.

Ball Screw Position	PLC High Register	PLC Low Register
0.2250	00000	02250
1.1592	00001	01592
22.9923	00022	09923
100.5820	00100	05820

In this Chapter you will learn about:

Drawings

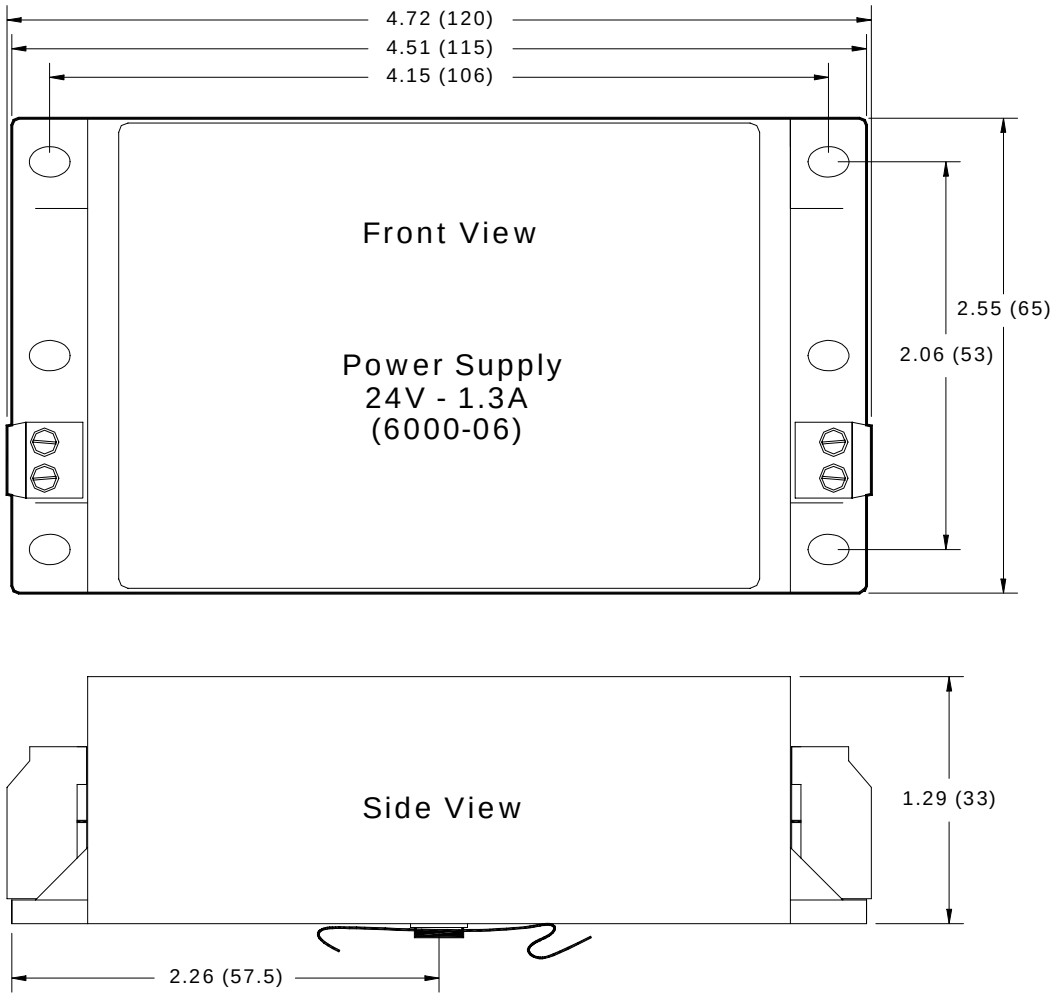


Figure B-1: ± 24Vdc @ 1.3 Amp Power Supply Dimensions (6000-06)

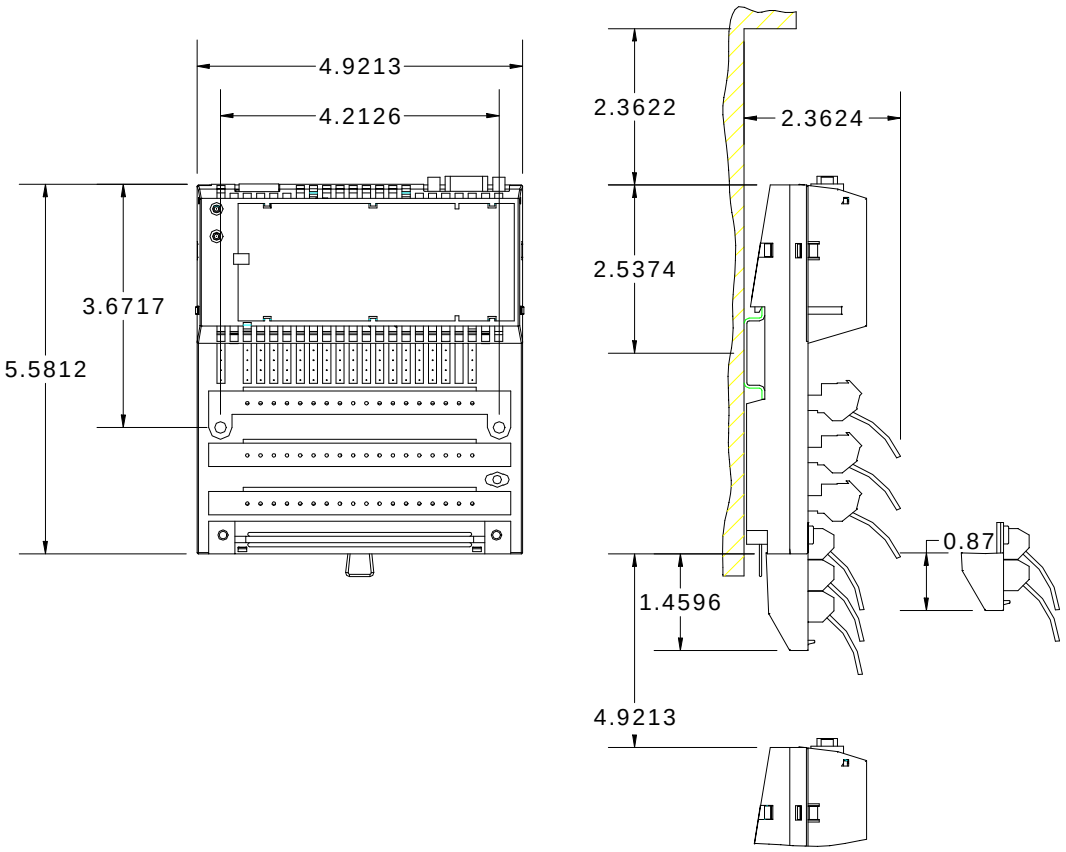


Figure B-2: IFC 210R Momentum Module Dimensions (1003-02)

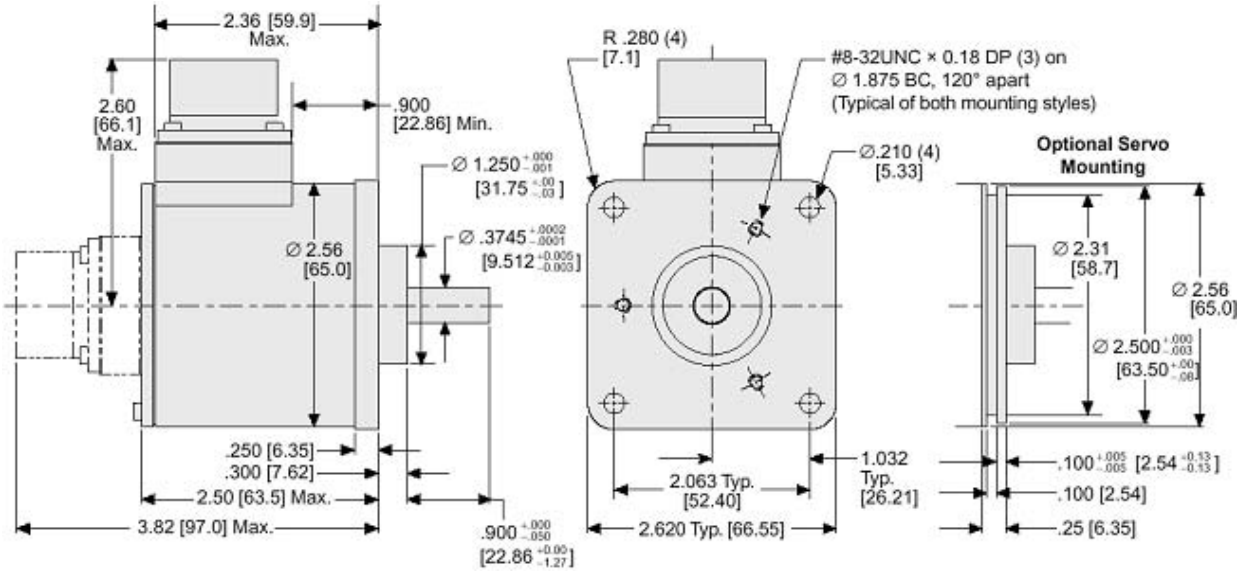


Figure B-3: 3000 Series Resolver Dimensions (3000-XX)

For Servo Motor Dimensions, refer to Motor Manual P/N 5002-0. If necessary, contact your I²T Technical Support at 412-828-1200.

Figure B-4: BM Series Motor with Resolver Dimensions

For Servo Drive Dimensions, refer to Servo Drive Manuals. If necessary, contact your I²T Technical Support at 412-828-1200.

Figure B-5: BA Series Servo Drive Dimensions

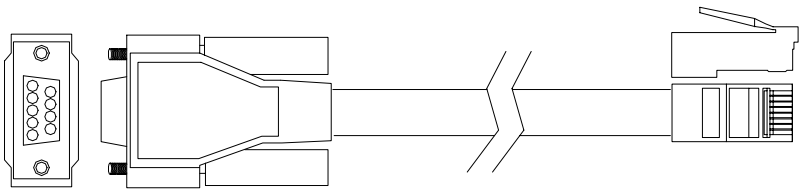


Figure B-6: RJ45 Module-to-Computer Cable (P/N 4005-10)

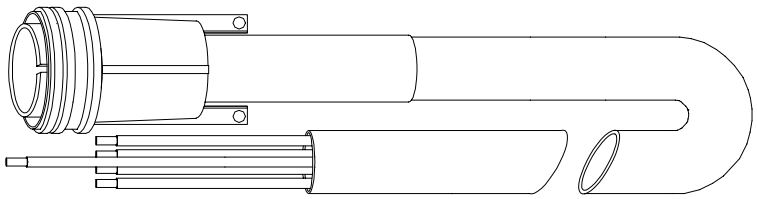


Figure B-7: Resolver Cable (P/N 4000-XXX)

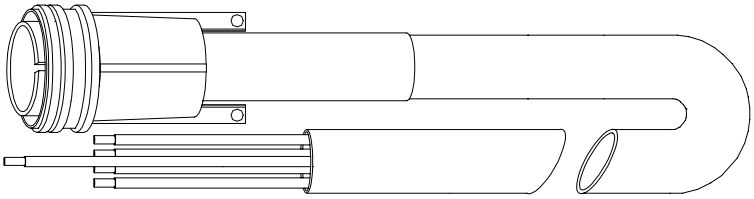


Figure B-8: Motor-to-Drive Cable (P/N PMC-XX)

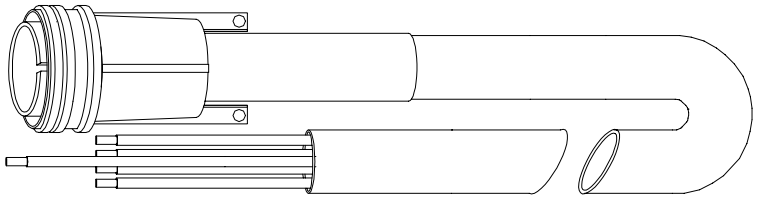


Figure B-9: Motor with Resolver-to-Module Cable (P/N PFC-XX)

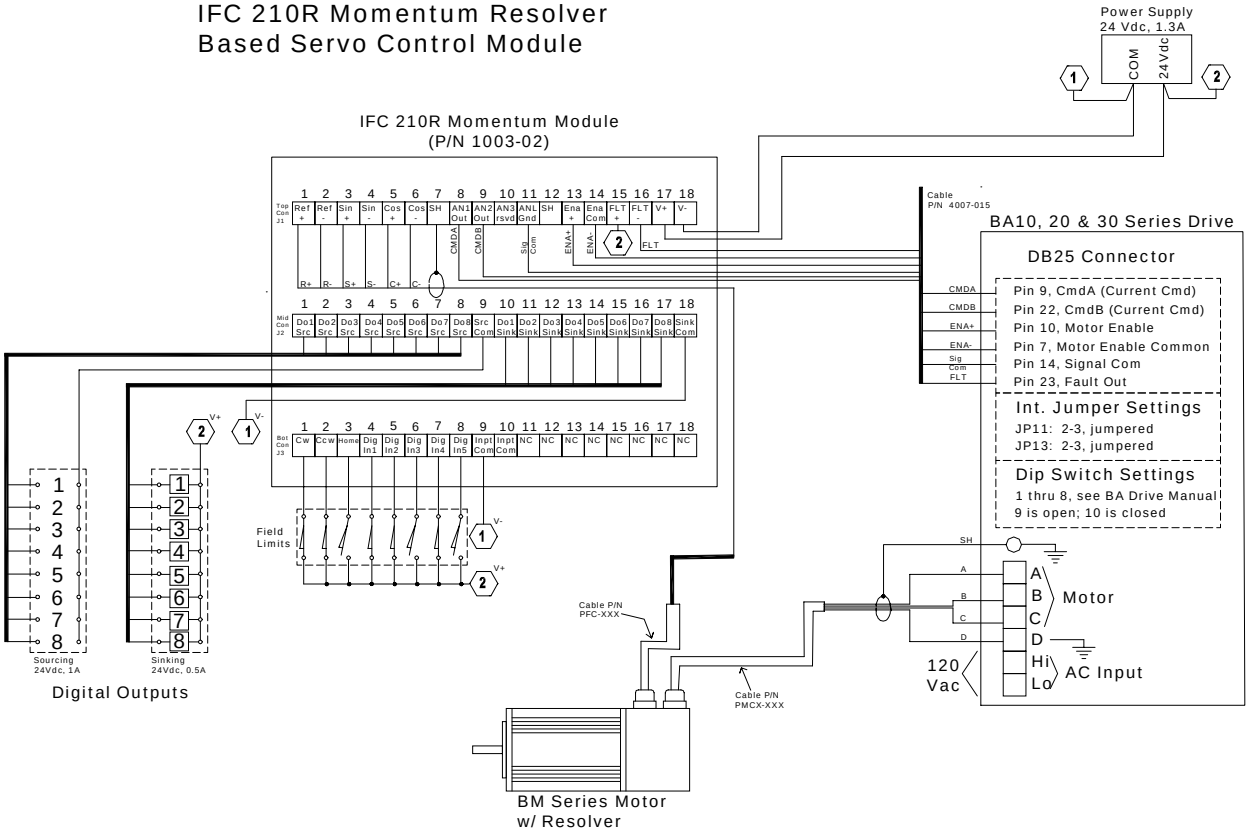


Figure B-10: IFC 210R Axis Wiring Configuration

J1 (Top Connector)

Pin #	Description
1	Ref +
2	Ref -
3	Sin +
4	Sin -
5	Cos +
6	Cos -
7	Shield
8	Phase A, AO1
9	Phase B, AO2
10	Phase C
11	AO Common
12	Shield
13	Enable
14	Common
15	Fault +
16	Fault -
17	+24 Vdc
18	PS Common

J2 (Middle Connector)

Pin #	Description
1	Source DO1
2	Source DO2
3	Source DO3
4	Source DO4
5	Source DO5
6	Source DO6
7	Source DO7
8	Source DO8
9	Source Common
10	Sink DO1
11	Sink DO2
12	Sink DO3
13	Sink DO4
14	Sink DO5
15	Sink DO6
16	Sink DO7
17	Sink DO8
18	Sink Common

J3 (Bottom Connector)

Pin #	Description
1	CW EOT Switch
2	CCW EOT Switch
3	Home Switch
4	Input 1
5	Input 2
6	Input 3
7	Input 4
8	Input 5
9	Input Common
10	Input Common
11	NC
12	NC
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC

Figure B-11: IFC 210R Connection Diagram

In this Chapter you will learn about:

PLC Low Level Commands

1000 Monitor Axis Data

1001 Get Fault/Status Codes

1002 Get Module Status

1003 Get Firmware Information

1004 Get Axis Fault Mask

1005 Get Baud Rate Index

1006 Poll Daughter Board for Command Response

1007 Get Extended Register Data, Output

1008 Get Axis 1 Information

1009 Get Axis 2 Information

1010 Get Digital Inputs

1011 Get Analog Inputs/Outputs

1012 Get Latched Input Position *(in User Units)*

1013 Get Axis 1 Preset Limit Position *(in User Units)*

1014 Get Axis 2 Preset Limit Position *(in User Units)*

1015 Get Active Function Mask

1016 Get Speed Averaging time

1017 Get Over/Under Speed Limits *(in User Units)*

1018 Get Digital Output Modes

1019 Get Limit Switches

1020 Get Current Positions *(in User Units)*

1021 Get Current Position *(in Resolver Units)*
Get Current Position *(in Pulse Units)*

1022 Get Absolute Resolver Position *(in User Units)*
Get Encoder Position *(in User Units)*

1023 Get Speed *(in User Units)*
Get Speed *(in Pulse Units)*

1024 Get Home Offset *(in User Units)*

1025 Get Speed Reference Range

1028 Get Home Feedrate Multiplier *(in Percent)*

1033 Read Acceleration/Deceleration Table

1034 Read Axis 1 Move Table *(in User Units)*

1035 Read Axis 2 Move Table *(in User Units)*

1036 Read Move Table Status

1038 Read Accel/Decel for Immediate Moves

1040 Get Blended Move Status and Index

1041 Get Velocity Command Multiplier
Get M-Set Information

1045 Get Registration Move Settings

1046 Get Registration Speed and Distance

1049 Get Axis Enabled

1050 Get EOT Limits *(in User Units)*

1051 Get EOT Limits *(in Resolver Units)*
Get EOT Limits *(in Pulse Units)*

1052 Read Four Words from 80196 Memory

1053 Get Analog Deadband *(in Analog Counts)*

1054 Get PID Setups

1055 Get PID Parameters

1056 Get Analog Clamp

1057 Get PID Limits
Get Tracking Error Limit *(in User Units)*

1058 Get PID Analog Setpoint

1059 Get PID Position/Velocity Setpoints *(in User Units)*

1060 Get Maximum PID Trim Output

1061 Get PID Base Analog Output

1065 Get Resolver Setup Mask (New Version)

1066 Get Encoder Lines

1069 Get Extended Register Data, Input

1070 Get Rollover *(in User Units)*

1071 Get Rollover *(in Resolver Units)*
Get Rollover *(in Pulse Units)*

1072 Get Gear Ratio

1075 Get Setup Mask

1076 Get Module Fault Outputs

1077 Get Absolute Gear Ratio

1078 Get Absolute Reference Offset *(in User Units)*

1079 Get Absolute Reference Offset *(in Resolver Units)*

1080 Get CAM Index

1081 Get CAM Point *(in User Units)*

1082 Get CAM Point *(in Resolver Units)*
Get CAM Point *(in Pulse Units)*

1083 Get CAM Status

1086 Get CAM Coefficients A and B

1087 Get CAM Coefficient C

1088 Get Master Position *(in User and Resolver Units)*
Get Master Position *(in User and Pulse Units)*

1089 Get Extended Register Mode

1090 Get Command Statistics

1095 Read Eight Bytes from 80196 Memory

1097 Get Firmware Size and Location

1098 Read Axis Setup Address Size and Location

1099 Read Four Words from 80196 Memory

2004 Set Axis Fault Mask

2005 Set Baud Rate

2006 Send Command to PIC Daughter Board

2007 Set Extended Register Data, Output

2010 Set Digital Outputs

2011 Set Analog Outputs

2013 Set Axis 1 Preset Limit Position *(in User Units)*

2014 Set Axis 2 Preset Limit Position *(in User Units)*

2015 Set Axis Functions

2016 Set Speed Averaging Time

2017 Set Over/Under Speed Limits *(in User Units)*

2018 Set Digital Output Mode

2020 Set Current Position *(in User Units)*

2022 Set Internal Homing
Set Encoder Position *(in User Units)*

2024 Set Home Offset *(in User Units)*

2025 Set Speed Reference Range

2026 Move Absolute *(in Resolver Units)*
Move Absolute *(in Pulse Units)*

2028 Get Home Feedrate Multiplier *(in Percent)*

2029 Change Speed *(in User Units)*

2030 Move Absolute *(in User Units)*

2031 Move Incremental *(in User Units)*

2032 Start Continuous Move *(in User Units)*

2033 Set Acceleration/Deceleration Table Entry

2034 Set Axis 1 Move Table Entry *(in User Units)*

2035 Set Axis 2 Move Table Entry *(in User Units)*

2036 Move from Table

2037 Halt Motion

2038 Set Accel/Decel for Immediate Moves

2039 Home Axis

2040 Execute Linked Move M-Set Axis

2041 Set Velocity Command Multiplier
Set M-Set Info

2045 Set Registration Move Settings

2046 Set Registration Speed and Distance

2049 Enable Axes

2050 Set EOT Limits *(in User Units)*

2051 Set EOT Limits *(in Resolver Units)*
Set EOT Limits *(in Pulse Units)*

2053 Get Analog Deadband *(in Analog Counts)*

2054 Set PID Setups

2055 Set PID Parameters

2056 Set Analog Clamp

2057 Set PID Limits
Set Tracking Error Limits *(in User Units)*

2058 Set PID Analog Setpoint

2059 Set PID Position/Velocity Setpoints *(in User Units)*

2060 Set Maximum PID Trim Output

2061 Set PID Base Analog Output

2065 Set Resolver Setup Mask New Version

2066 Set Encoder Lines

2069 Set Extended Register Data, Output

2070 Set Rollover *(in User Units)*

2071 Set Rollover *(in Resolver Units)*
Set Rollover *(in Pulse Units)*

2072 Set Gear Ratio

2073 Set Absolute Reference Position *(in User Units with Range Control)*

2074 Initiate Dual Resolver Procedure

2075 Set Axis Setup Mask

2076 Set Module Fault Outputs

2077 Set Absolute Gear Ratio

2078 Set Absolute Reference Position *(in User Units)*

2079 Set Absolute Reference Offset *(in Resolver Units)*

2080 Set CAM Index

2081 Set CAM Point *(in User Units)*

2082 Set CAM Point *(in Resolver Units)*
Set CAM Point *(in Pulse Units)*

2083 Set CAM Function

2084 Initialize CAM Table

2085 Modify CAM Table

2086 Save CAM Table to Flash

2087 Load CAM Table from Flash

2088 Set Master Position *(in User Units)*

2089 Set Extended Register Mode

2091 Default EEPROM

2092 Reset Module

2093 Copy RAM Setup to Flash

2094 Write One Byte to 80196 Memory

2095 Write One Word to 80196 Memory

2096 Write One Long Word to 80196 Memory

2097 Write One Quad Word to 80196 Memory

2098 Write Four Words to 80196 Memory

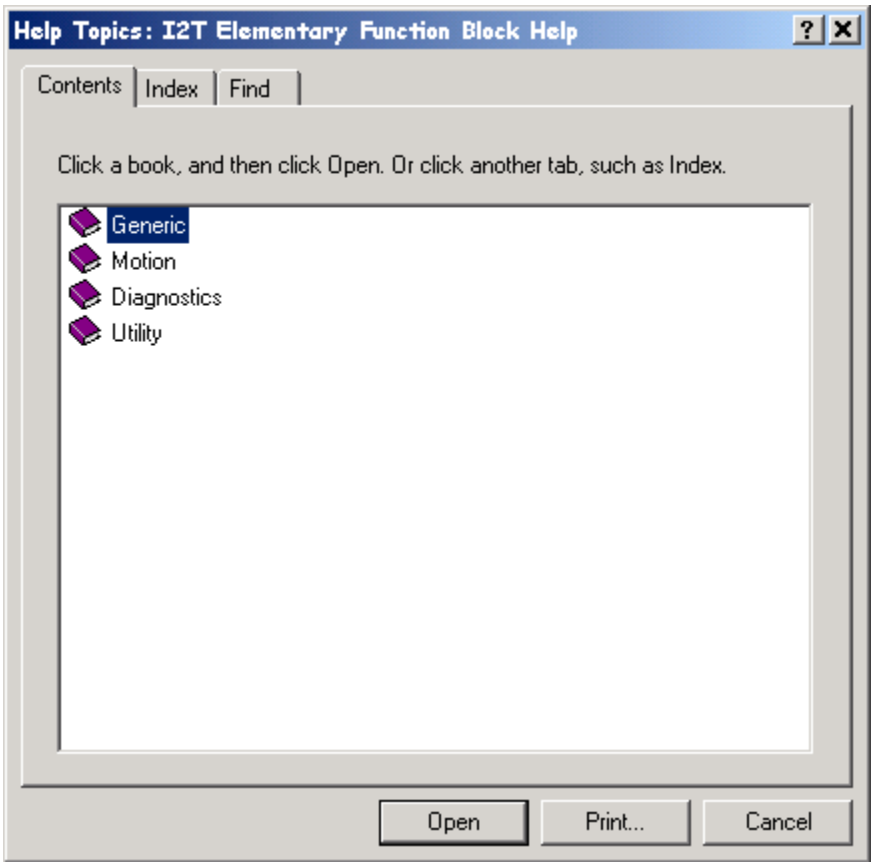
2099 Copy Firmware from RAM to FLASH

In this Chapter you will learn about:

Getting Started with Elementary Function Blocks

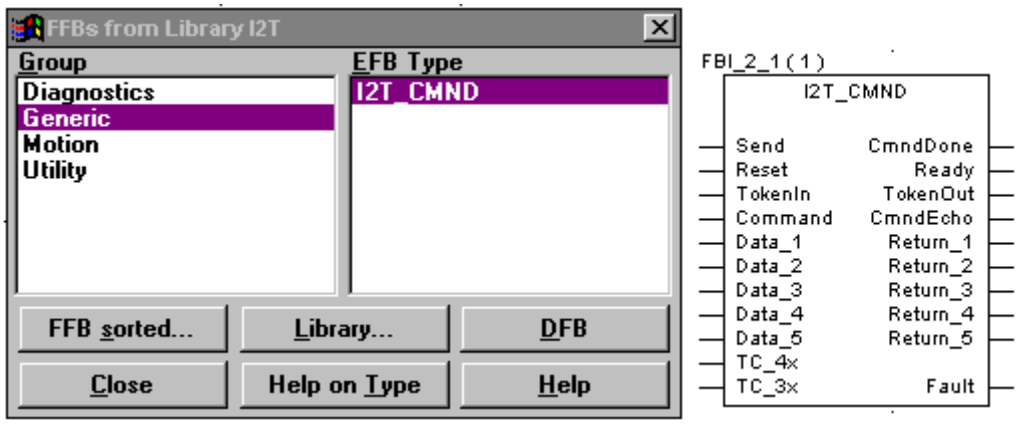
D.1. Elementary Function Blocks

The EFB "Elementary Function Block" Library consists of four groups of blocks: Diagnostics, Generic, Motion, and Utility. Use the on-line help file for the most current information regarding EFBs.



Generic Function Blocks allow the user to parameterize and send a generic command to the IFC 210R motion control module. The command echo and raw return data are available on the block outputs.

D.1.1. Command - Generic Block



This block allows the user to parameterize and send a generic command to the IFC 210R. The command echo and raw return data are available on the block outputs.

Reference Help Topics under the Pull-down menu for an up-to-date list of valid commands and parameters. Use the Data_1, Data_2, …, Data_6 block inputs to parameterize the command. The command value is entered into the block via the Command input. Once a command to the motion control module completes, the CmndEcho output equals the Command input value. The values associated with the Return_1, Return_2, …, and Return_6 outputs are command specific.

Block Utilization

Send — This Boolean input instructs the block to issue the specified command to the motion control module. When the instruction completes the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset — This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the CmndEcho, Return_1, Return_2, …, Return_6 and Fault outputs are set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn — This input allows the block to assess the value of the communication token.

TC_4x — This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

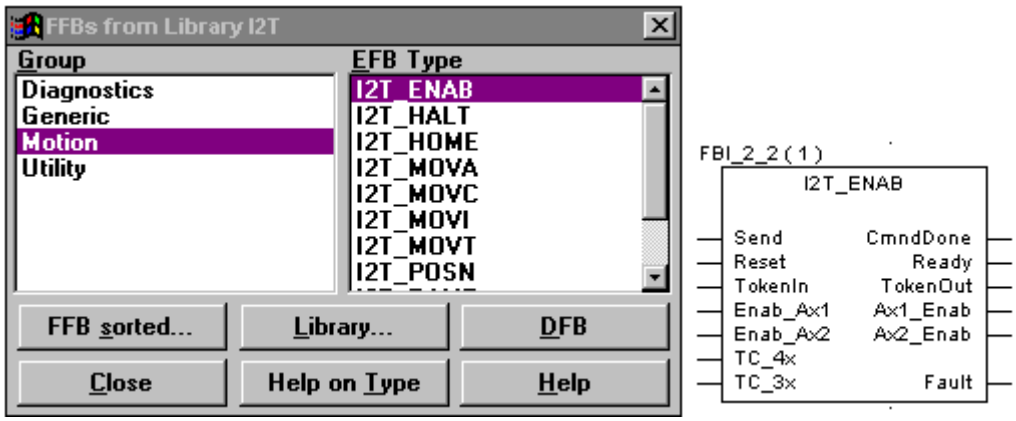
Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from IFC 210R.

Code 2. Illegal command. Inputted command is out of valid command range.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

D.1.2. Drive Enable/Disable - Motion Block



This block allows the user to enable and disable the drive(s) associated with the IFC 210R.

Send This Boolean input instructs the block to issue the drive enable/disable command to the IFC 210R. Once the command completes, the block then issues a command to interrogate drive status. Once the drive enable status matches the block inputs, the Ax1_Enab and Ax2_Enab outputs are set accordingly and the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high, the Ax1_Enab and Ax2_Enab outputs are set low and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

Enab_Ax1 If high, this input instructs the IFC 210R to enable the drive for axis 1. If low, the drive for axis 1 is commanded to disable.

Enab_Ax2 If high, this input instructs the IFC 210R to enable the drive for axis 2. If low, the drive for axis 2 is commanded to disable. ***Note:*** On single axis modules, only Enab_Ax1 applies.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

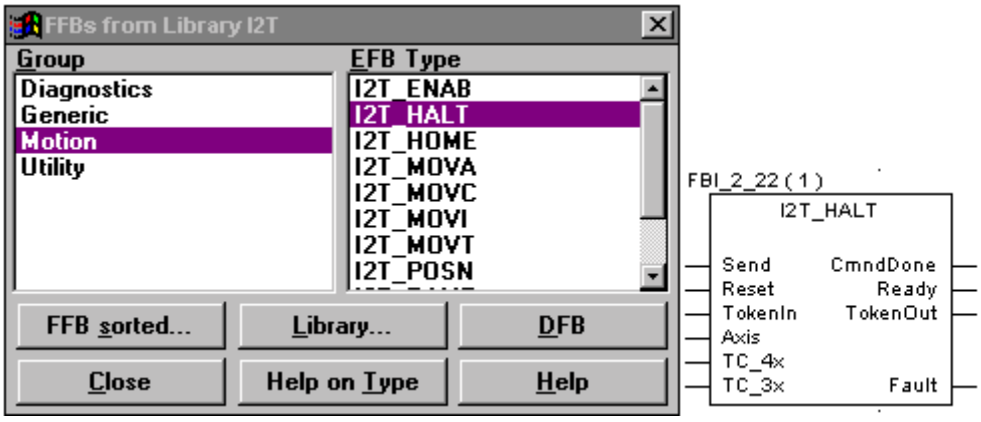
Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from the IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

D.1.3. Halt – Motion Block



This block allows the user to stop execution of a motion profile.

Send This Boolean input instructs the block to issue a halt command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

Axis This input value designates the axis for this command. The value should be either 1, 2 or 3 (3 = both axes).

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

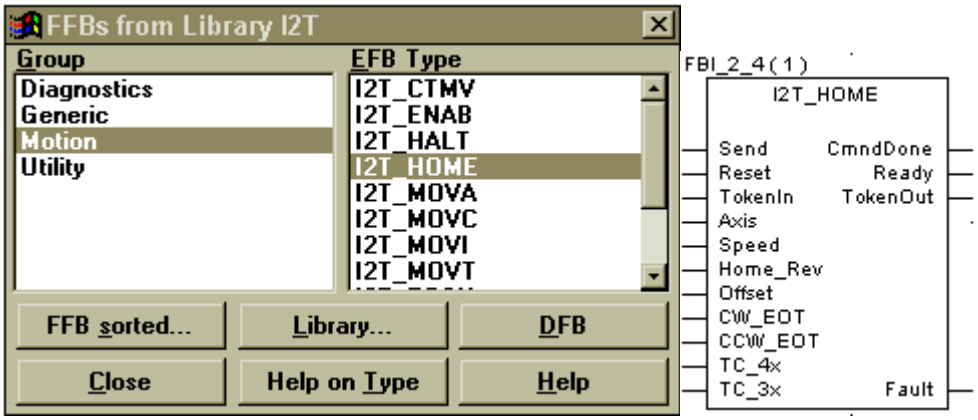
Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from motion control module.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the motion control module, a communication time out will occur.

Code 100. Invalid axis input. The Axis input must be 1, 2 or 3 (3 = both axes).

D.1.4. Home – Motion Block



This block allows the user to issue a referencing move to an axis. The axis will seek the home limit switch in the designated direction. If already on the home limit switch, the axis will move off of the home switch in a direction opposite to the commanded direction. If an EOT switch is encountered, the axis will reverse direction and continue seeking the home limit switch. If the switch is encountered in the designated direction, the axis will move to the null point of its feedback device and stop. If the home limit switch is encountered, while the axis is moving opposite to the homing direction, the axis will move past the switch. Once the switch changes state, the axis will then approach the home limit switch in the designated homing direction.

Send — This Boolean input instructs the block to issue a home command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset — This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn — This input allows the block to assess the value of the communication token.

Axis — This input value designates the axis for this command. The value should be either 1 or 2.

Speed — This floating-point input contains the speed information for the velocity profile. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

Home_Rev This Boolean input instructs the axis to seek the home switch in the reverse (negative or REV) direction.

Offset This floating-point input contains the position that will be set when homing completes.

FWD_EOT This floating-point input contains the position that will be set as the software end-of-travel limit in the positive or forward direction of travel. When this value equals the REV_EOT value the software end-of-travel limits are disabled.

REV_EOT This floating-point input contains the position that will be set as the software end-of-travel limit in the negative or reverse direction of travel. When this value equals the FWD_EOT value the software end-of-travel limits are disabled.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

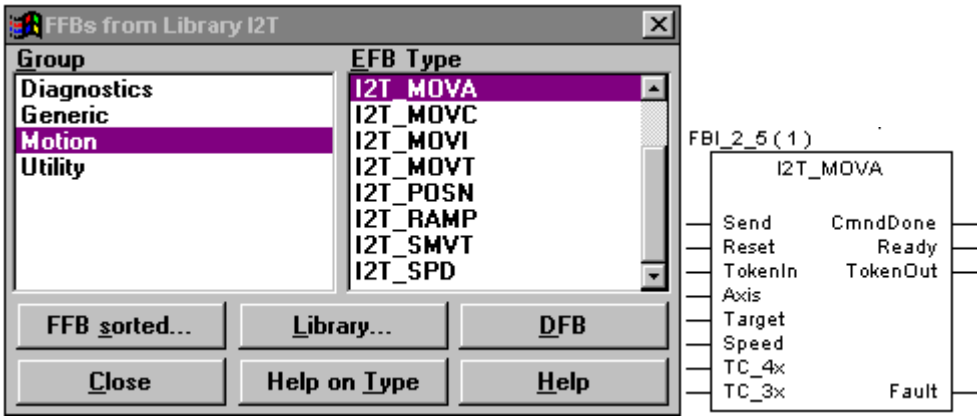
Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

Code 101. Invalid axis input. The Axis input must be either 1 or 2.

D.1.5. Move to Absolute Position – Motion Block



This block allows the user to issue a move to either axis 1 or 2. The axis will seek the absolute position specified in the command.

Send — This Boolean input instructs the block to issue the absolute move command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset — This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn — This input allows the block to assess the value of the communication token.

Axis — This input value designates the axis for this command. The value should be either 1 or 2. If rollovers are a concern, motion in the positive or negative direction can be forced. Adding 8000 hex to the axis value forces the axis to seek the Target in the positive direction. Adding 4000 hex to the axis value forces the axis to seek the Target in the negative direction.

Target — This floating-point input contains the position the axis is to move to. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

Speed

This floating-point input contains the speed information for the velocity profile. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

TC_4x

This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x

This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

Fault

This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

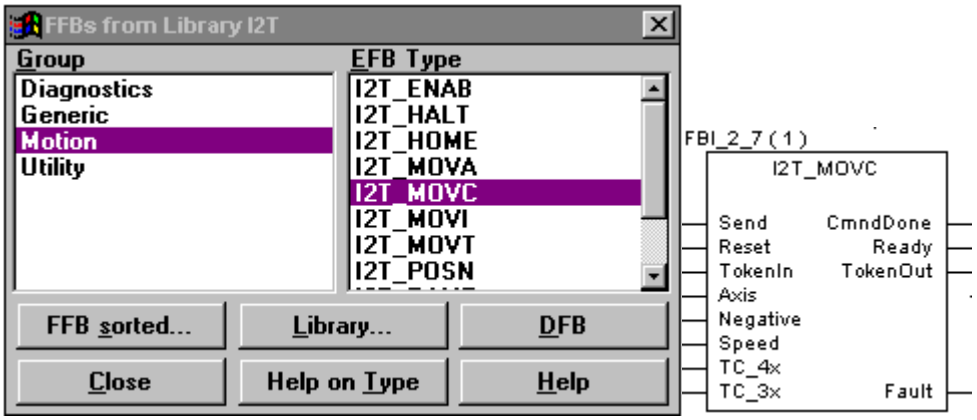
Code 1. Communication time out. Failed to receive response from IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

Code 101. Target not positive. The inputted position value must NOT be a negative real number.

Code 102. Invalid axis input. The Axis input must be either 1 or 2 or with either high order bit set.

D.1.6. Move Continuous – Motion Block



This block allows the user to issue a continuous move to either axis 1 or 2. The axis will move in the specified direction until the drive is disabled, a halt is issued or another move command is issued.

Send — This Boolean input instructs the block to issue a continuous move command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset — This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn — This input allows the block to assess the value of the communication token.

Axis — This input value designates the axis for this command. The value should be either 1 or 2.

Negative — This input designates the continuous move to occur in the reverse direction.

Speed — This floating-point input contains the speed information for the velocity profile. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_4x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

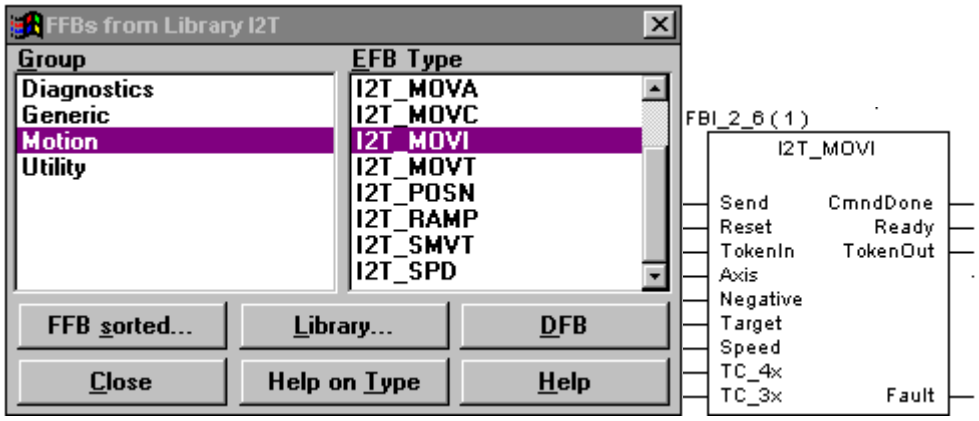
Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from the IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

Code 103. Invalid axis input. The axis input must be either 1 or 2.

D.1.7. Move Incremental Position – Motion Block



This block allows the user to issue a move to either axis 1 or 2. The axis will move in the specified direction by the inputted Target amount.

Send This Boolean input instructs the block to issue an incremental move command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

Axis This input value designates the axis for this command. The value should be either 1 or 2.

Negative This input designates the incremental move to occur in the reverse direction.

Target This floating-point input contains the distance the axis is to move relative to its current position. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

Speed This floating-point input contains the speed information for the velocity profile. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

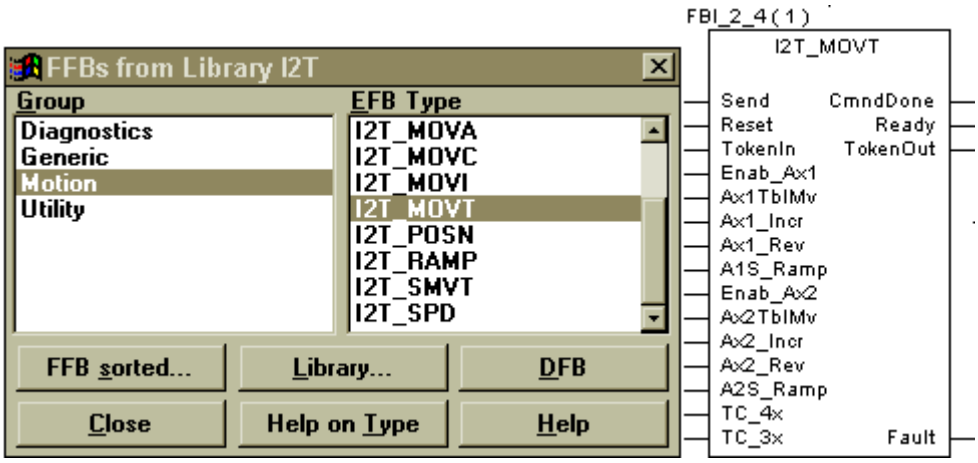
Code 1. Communication time out. Failed to receive response from the IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the motion control module, a communication time out will occur.

Code 101. Target not positive. The inputted position value must NOT be a negative real number.

Code 102. Invalid axis input. The axis input must be either 1 or 2.

D.1.8. Move Table – Motion Block



This block allows the user to issue either an absolute or incremental move from a predefined table of moves. The move is issued to either axis 1, 2 or both.

Send This Boolean input instructs the block to issue a table move command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

Enab_Ax1, Enab_Ax2 — The command utilized to send a table move also looks to enable and disable the drive when the table move number for the associated axis is zero (not commanding a table move). Therefore, these input pins should reflect the desired state of the drive(s) when issued.

Ax1TblMv, Ax2TblMv — These input values contain the move number in the axis move table. The table for each axis contains 16 moves, numbered 1 through 16. If a zero is entered, the axis is not instructed to move.

Ax1_Incr, Ax2_Incr — These Boolean inputs instruct the block to issue an incremental move from table.

Ax1_Rev, Ax2_Rev — If the corresponding incremental move input is on, these Boolean inputs instruct the block to issue an incremental move in the reverse direction.

A1S_Ramp, A2S_Ramp — These Boolean inputs, when high, instruct the corresponding axis to utilize S-curve acceleration and deceleration for the commanded table move. Linear accel and decel are used when these inputs are low.

TC_4x — This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x — This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

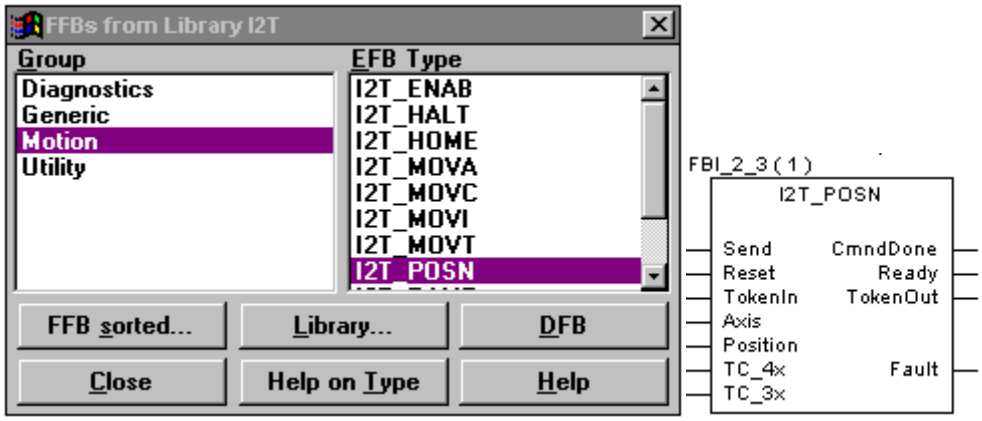
Fault — This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from the IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

Code 103. Invalid table input. The inputted value for either Ax1TblMv or Ax2TblMv is greater than 16.

D.1.9. Set Position – Motion Block



This block allows the user to set the position (in user units) of the specified axis.

Send This Boolean input instructs the block to issue the set position command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

Axis This input value designates the axis for this command. The value should be either 1 or 2.

Position This floating-point input contains the position to set for the axis. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

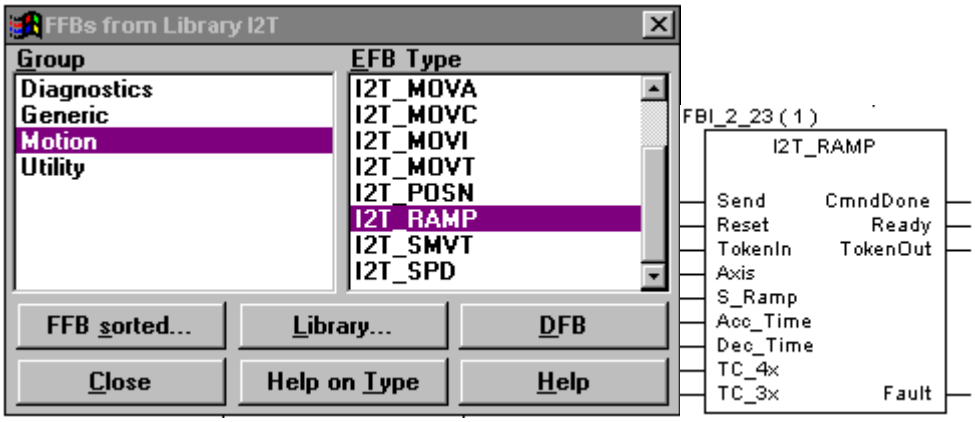
Code 1. Communication time out. Failed to receive response from IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

Code 101. Target not positive. The inputted position value must NOT be a negative real number.

Code 0. Invalid axis input. The axis input must be either 1 or 2.

D.1.10. Set Accel/Decel Ramps – Motion Block



This block allows the user to set the default acceleration and deceleration times (in milliseconds). Also, the ramp profile is specified by this command. The profile can be either linear or sinusoidal (S-Ramp).

Send This Boolean input instructs the block to issue a set acceleration and deceleration command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

Axis This input value designates the axis for this command. The value should be either 1 or 2.

S_Ramp Setting this Boolean input high instructs the block to send the command enabling sinusoidal ramping.

Acc_Time Acceleration time (in milliseconds).

Dec_Time Deceleration time (in milliseconds).

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

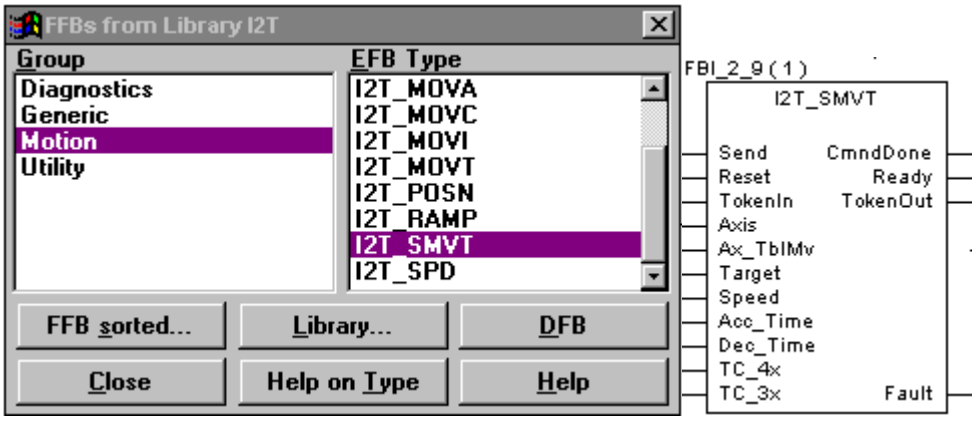
Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 2. Communication time out. Failed to receive response from the IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

Code 1. Invalid axis input. The axis input must be either 1 or 2.

D.1.11. Set Move Table – Motion Block



This block allows the user to configure a table move entry.

Send This Boolean input instructs the block to write the target position, speed, acceleration time and deceleration time for a move table entry into the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

Axis This input value designates the axis for this command. The value should be either 1 or 2.

Ax_TblMv This input value contains the move number in the axis move table. The table for each axis contains 16 moves, numbered 1 through 16.

Target This floating-point input contains the positional information for the table. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

Speed This floating-point input contains the speed information for the velocity profile. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

Acc_Time This integer value contains the acceleration ramp time in milliseconds. Linear or S-Ramp profile selection is set by the I2T_RAMP block.

Dec_Time This integer value contains the deceleration ramp time in milliseconds. Linear or S-Ramp profile selection is set by the I2T_RAMP block.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

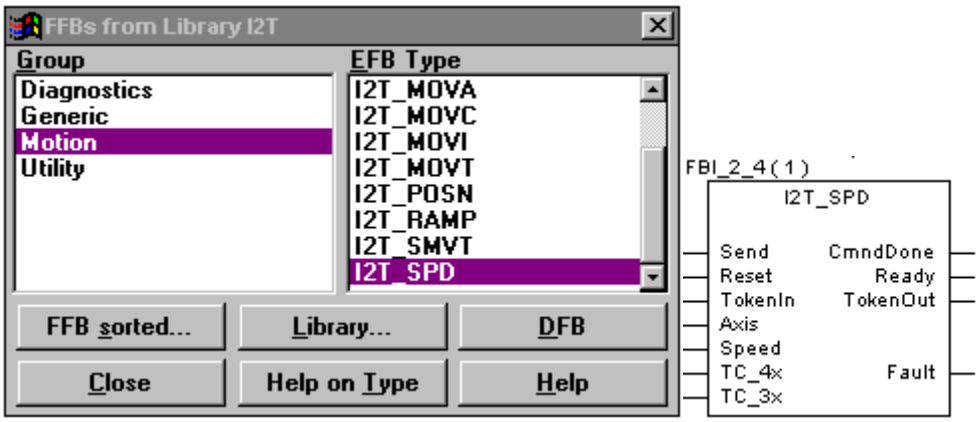
Code 0. Communication time out. Failed to receive response from motion control module.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

Code 2. Invalid table input. The inputted value to reference a table move is zero or greater than 16.

Code 3. Invalid axis input. The axis input must be either 1 or 2.

D.1.12. Set Speed – Motion Block



This block allows the user to set the speed (in user units per second) of the specified axis. This command is issued while the axis is in motion, to adjust the speed of the current motion profile.

Send This Boolean input instructs the block to issue the set speed command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

Axis This input value designates the axis for this command. The value should be either 1 or 2.

Speed This floating-point input contains the desired speed for the axis. The value should be positive. The inputted value is translated into two integer values. The high word contains the integer portion of the number and the low word contains the four most significant decimal places.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

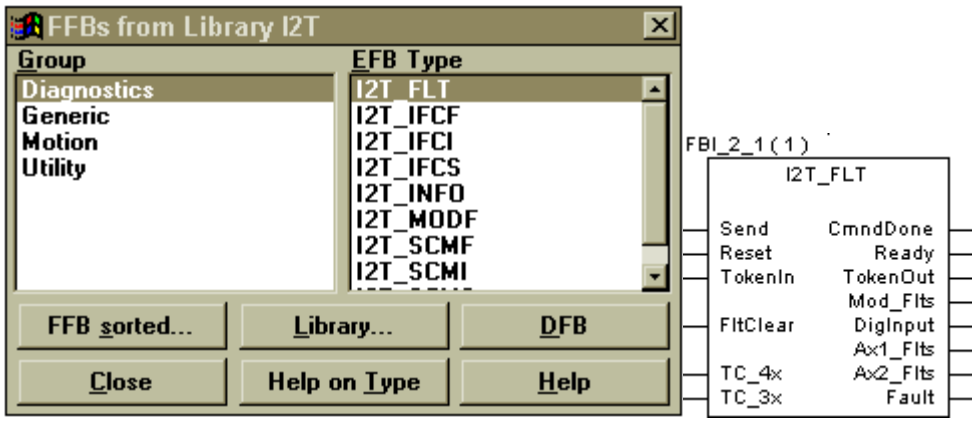
Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from the IFC 210R.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

Code 4. Invalid axis input. The axis input must be either 1 or 2.

D.1.13. Fault Handler – Diagnostics Block



This block allows the user to read and clear faults from the motion control module. The block returns the state of the module faults, digital inputs and faults for both axes.

Send This Boolean input instructs the block to issue a read/clear fault command to the IFC 210R. Once the command completes, the CmndDone Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized and is not faulted.

Reset This Boolean input instructs the block to reinitialize. When this occurs the CmndDone Boolean output is set low, the Ready Boolean output is set high and the Fault output is set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token.

FltClear Setting this Boolean input high instructs the block to issue clear the fault once the fault information has been read.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the motion control module).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

Mod_Flts This output word contains bit-masked module faults. See the Module Faults block for bit definitions.

DigInput This output word contains the status of the digital inputs. See the IFC Digital Inputs block for bit definitions.

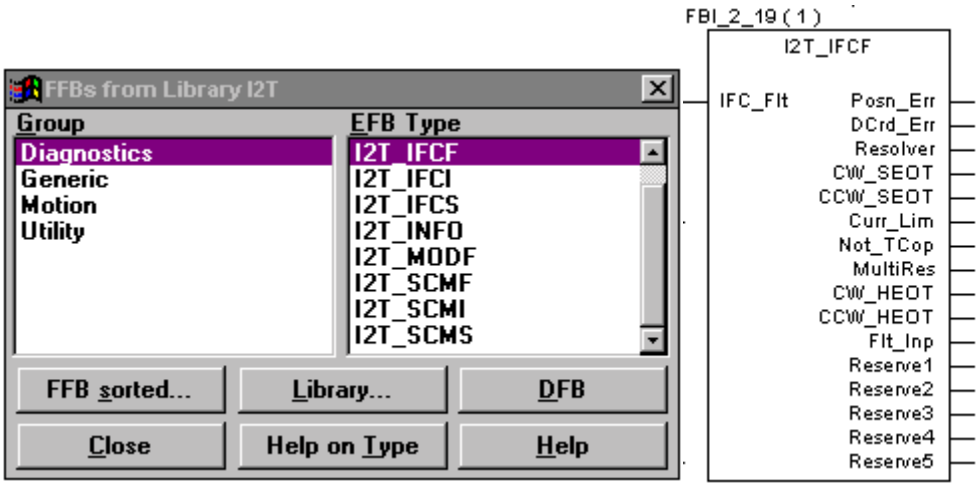
Ax1_Flts, Ax2_Flts These output words contain bit masked axis faults. See the IFC Axis Faults block for bit definitions.

Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from the IFC 210R.

Code 2. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

D.1.14. Axis Faults – Diagnostics Block



This block allows the user to decode the axis fault word from an IFC 210R Single-axis Resolver Based Servo Module.

IFC_Flt This input word is resolved into Boolean block outputs. The definitions are shown in the following table.

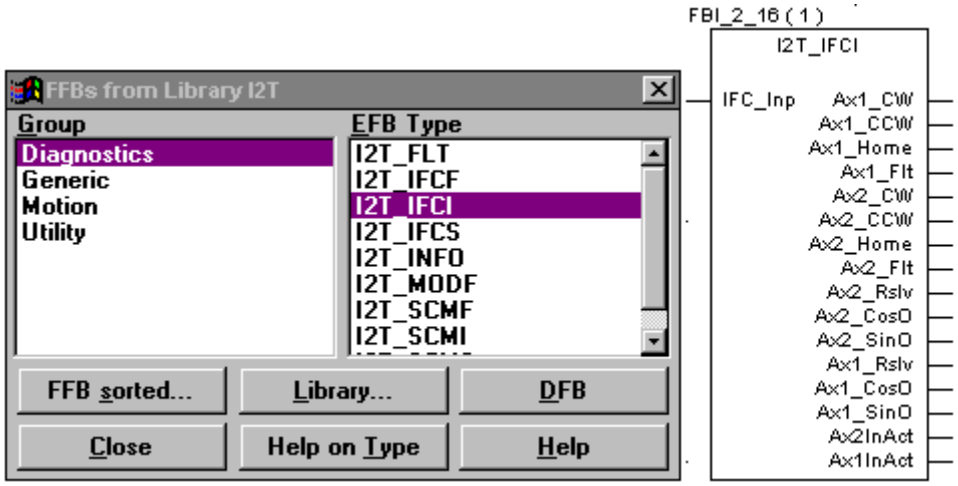
Posn_Err Hex Bit: 0x0001. Position deviation error.

DCrd_Err Hex Bit: 0x0002. Daughter card error.

Resolver Hex Bit: 0x0004. Resolver fault.

FWD_SEOT	Hex Bit: 0x0008. Forward software end-of-travel.
REV_SEOT	Hex Bit: 0x0010. Reverse software end-of-travel.
Curr_Lim	Hex Bit: 0x0020. Current limit.
Not_Tcop	Hex Bit: 0x0040. Not traffic copped.
MultiRes	Hex Bit: 0x0080. Multiple resolver package fault.
FWD_HEOT	Hex Bit: 0x0100. Forward hardware end-of-travel.
REV_HEOT	Hex Bit: 0x0200. Reverse hardware end-of-travel.
Flt_Inp	Hex Bit: 0x0400. Drive fault.
Reserve1	Hex Bit: 0x0800.
Reserve2	Hex Bit: 0x1000.
Reserve3	Hex Bit: 0x2000.
Reserve4	Hex Bit: 0x4000.
Reserve5	Hex Bit: 0x8000.

D.1.15. Digital Inputs – Diagnostics Block



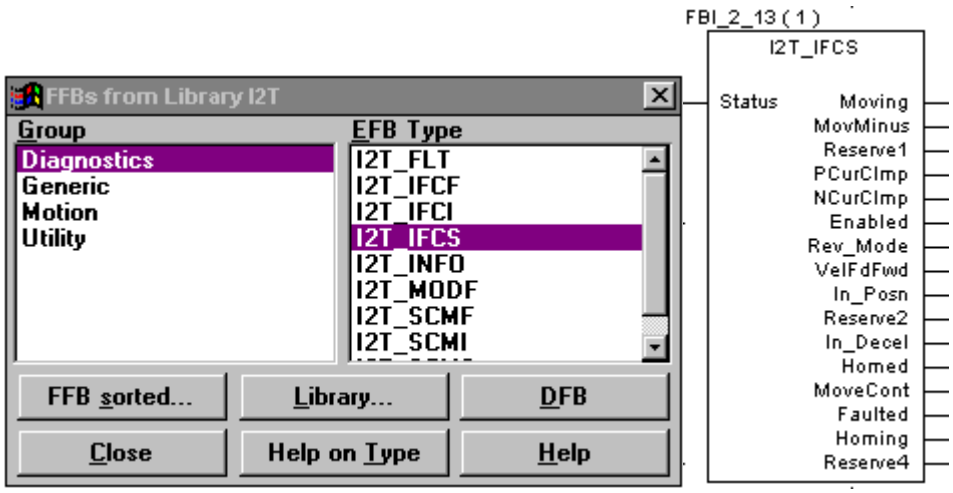
This block allows the user to decode the status of the digital inputs from an IFC servo motion control module.

IFC_Inp

This input word is resolved into Boolean block outputs. The definitions are shown in the following table.

Ax1_FWD	0x0001 Axis 1 Forward end-of-travel limit.
Ax1_REV	0x0002 Axis 1 reverse end-of-travel limit.
Ax1_Home	0x0004 Axis 1 home switch.
Ax1_Flt	0x0008 Axis 1 drive fault.
Ax2_FWD	0x0010 Axis 2 Forward end-of-travel limit.
Ax2_REV	0x0020 Axis 2 reverse end-of-travel limit.
Ax2_Home	0x0040 Axis 2 home switch.
Ax2_Flt	0x0080 Axis 2 drive fault.
Ax2_Rslv	0x0100 Axis 2 resolver fault.
Ax2_CosO	0x0200 Axis 2 cosine open.
Ax2_SinO	0x0400 Axis 2 sine open.
Ax1_Rslv	0x0800 Axis 1 resolver fault.
Ax1_CosO	0x1000 Axis 1 cosine open.
Ax1_SinO	0x2000 Axis 1 sine open.
Ax2InAct	0x4000 Axis 2 input active.
Ax1InAct	0x8000 Axis 1 input active.

D.1.16. Status Bits – Diagnostics Block



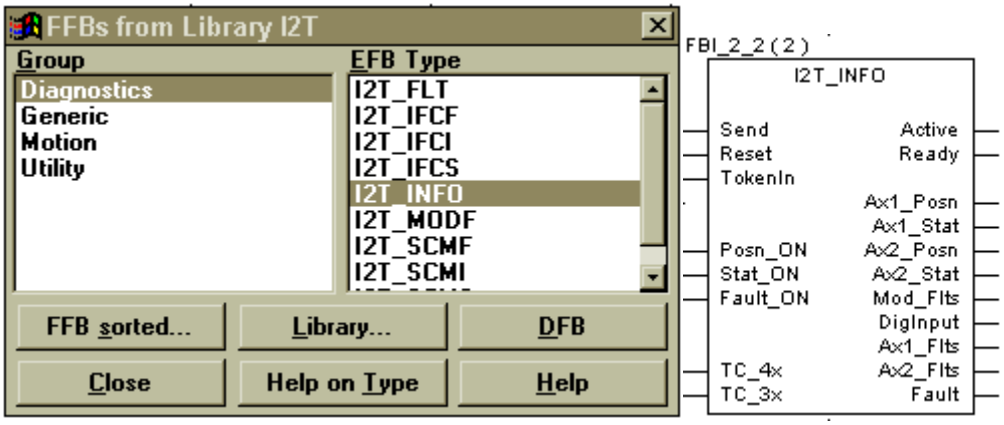
This block allows the user to decode the axis status word from an IFC 210R Single-axis Resolver Based Servo Module.

Status This input word is resolved into Boolean block outputs. The definitions are shown in the following table.

Moving	Hex Bit: 0x0001. Axis is moving.
MovMinus	Hex Bit: 0x0002. Axis is moving in the negative direction.
Reserve1	Hex Bit: 0x0004.
PcurClmp	Hex Bit: 0x0008. Positive current clamp.
NcurClmp	Hex Bit: 0x0010. Negative current clamp.
Enabled	Hex Bit: 0x0020. Servo drive enabled.
Rev_Mode	Hex Bit: 0x0040. Feedback signal is being read in reverse.
VelFdFwd	Hex Bit: 0x0080. Velocity feed forward is active.
In_Posn	Hex Bit: 0x0100. Axis is in-position.
Reserve2	Hex Bit: 0x0200.
In_Dece	Hex Bit: 0x0400. Axis is decelerating.

Homed	Hex Bit: 0x0800. Axis is referenced.
MoveCont	Hex Bit: 0x1000. Axis is executing a move continuous.
Faulted	Hex Bit: 0x2000. Axis is faulted.
Homing	Hex Bit: 0x4000. Axis is seeking its reference position.
Reserve4	Hex Bit: 0x8000.

D.1.17. Axis Information – Diagnostics Block



This block allows the user to read back information for the IFC 210R axes. The information includes position and status.

Send This Boolean input instructs the block to continuously issue read position, read status and read fault commands to the IFC 210R. Once the block begins reading from the module, the Active Boolean output is set high. Prior to sending the command, the block Ready output should be high, indicating the block has been initialized. Setting this input low will not clear the outputs of the block. Therefore, the user can interrupt this block to send other commands, while maintaining the last known position, status and faults of the axis.

Reset This Boolean input instructs the block to reinitialize. When this occurs the Active Boolean output is set low, the Ready Boolean output is set high, the Position, Status and the Fault outputs are set to zero. The block is reset dominant and will ignore the Send input while the Reset input is high.

TokenIn This input allows the block to assess the value of the communication token. This block does not set the communication token. When other blocks set the token to a non-zero value, the result is the same as setting the Send Boolean input low on this block.

Note: If this block is used in conjunction with the I2T_CTMV block, the Send inputs should be made mutually exclusive.

Phonon This input enables the block to update the position outputs for the axes. When this Boolean input is set low, the position outputs will be zeroed upon the next interruption to the block.

Stat_ON This input enables the block to update the status outputs for the axes. When this Boolean input is set low, the status outputs will be zeroed upon the next interruption to the block.

Fault_ON This input enables the block to update the module fault, digital input status and axis fault outputs. When this Boolean input is set low, the module fault, digital input status and axis fault outputs will be zeroed upon the next interruption to the block.

TC_4x This value indicates an offset to the command register (the first register traffic copped to the IFC 210R).

Example: A value of 101 applied to this pin indicates register 400101 is the command register.

TC_3x This value indicates an offset to the command echo register (the first register traffic copped from the IFC 210R).

Example: A value of 9 applied to this pin indicates register 300009 is the command echo register.

Ax1_Posn This floating-point output contains the current position of axis 1 in user units.

Ax1_Stat This output word contains the status of axis 1. See the IFC 210R Status Bits block for bit definitions.

Ax2_Posn This floating-point output contains the current position of axis 2 in user units.

Ax2_Stat This output word contains the status of axis 2. See the IFC 210R Status Bits block for bit definitions.

Mod_Flts This output word contains bit-masked module faults. See the Module Faults block for bit definitions.

DigInput This output word contains the status of the digital inputs. See the IFC 210R Digital Inputs block for bit definitions.

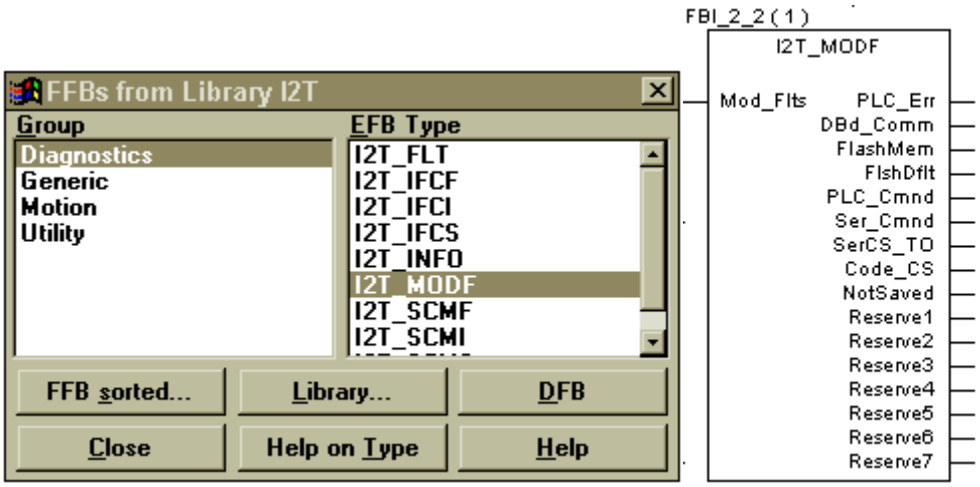
Ax1_Flts, Ax2_Flts These output words contain bit masked axis faults. See the IFC 210R Axis Faults block for bit definitions.

Fault This unsigned integer output provides a diagnostic fault code. Possible fault codes for this block are shown in the following table.

Code 1. Communication time out. Failed to receive response from motion control module.

Code 3. Invalid traffic copped register. Specified offset to either the 4xxxxx or the 3xxxxx points to a nonexistent register in the PLC. If the register pointed to is valid, but not traffic copped to the module, a communication time out will occur.

D.1.18. Module Faults – Diagnostics Block



This block allows the user to decode the module faults word from the IFC 210R.

Mod_Flts This input word is resolved into Boolean block outputs. The definitions are shown in the following table.

PLC_Err Hex Bit: 0x0001. PLC error.

DBd_Comm Hex Bit: 0x0002. Daughter board communications error.

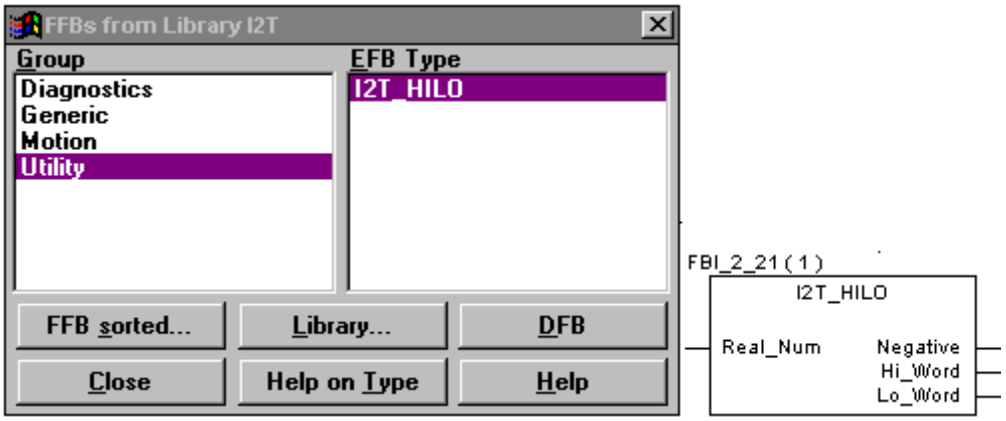
FlashMem Hex Bit: 0x0004. Flash memory error.

FlshDflt Hex Bit: 0x0008. Flash memory has default parameters.

PLC_Cmnd Hex Bit: 0x0010. PLC command error.

Ser_Cmnd	Hex Bit: 0x0020. Serial command error.
SerCS_TO	Hex Bit: 0x0040. Serial checksum or time-out error.
Code_CS	Hex Bit: 0x0080. Code checksum error.
NotSaved	Hex Bit: 0x0100. Parameters not saved to flash memory.
Reserve1	Hex Bit: 0x0200.
Reserve2	Hex Bit: 0x0400.
Reserve3	Hex Bit: 0x0800.
Reserve4	Hex Bit: 0x1000.
Reserve5	Hex Bit: 0x2000.
Reserve6	Hex Bit: 0x4000.
Reserve7	Hex Bit: 0x8000.

D.1.19. High/Low – Utility Block



This block allows the user to separate a floating-point number into its integer and decimal portions.

Real_Num	This input value contains a floating-point number.
Negative	This Boolean output is set high when the inputted floating point number is less than zero
Hi_Word	This integer output represents the positive magnitude of the floating point value integer portion
Lo_Word	This integer output represents the positive magnitude of the floating-point value decimal portion. The four most significant digits are outputted (i.e. 1792 = .1792 6 = .0006 915 = .0915).