



FREQUENCY
DEVICES™, INC.

90PGA Slot Card

Dual Channel Programmable
Amplifier Card

USER'S MANUAL





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Section 1
Front Panel Operation

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1.1 - Start Up

All 90PGA slot cards should be inserted into the 90IP chassis and controller while the power switch (rear panel) is in the **OFF** position (O). Once all slot cards have been inserted, the power switch can be moved to the **ON** position (I). Upon power-up, a micro-controller on each 90PGA slot card sends its configuration to the 90IP controller which can then be shown on the display. This is Frequency Devices' **SMART SLOT Technology**. See 90IP Operations Manual for chassis and controller operating instructions.

See **Figure 1** - Front Panel below

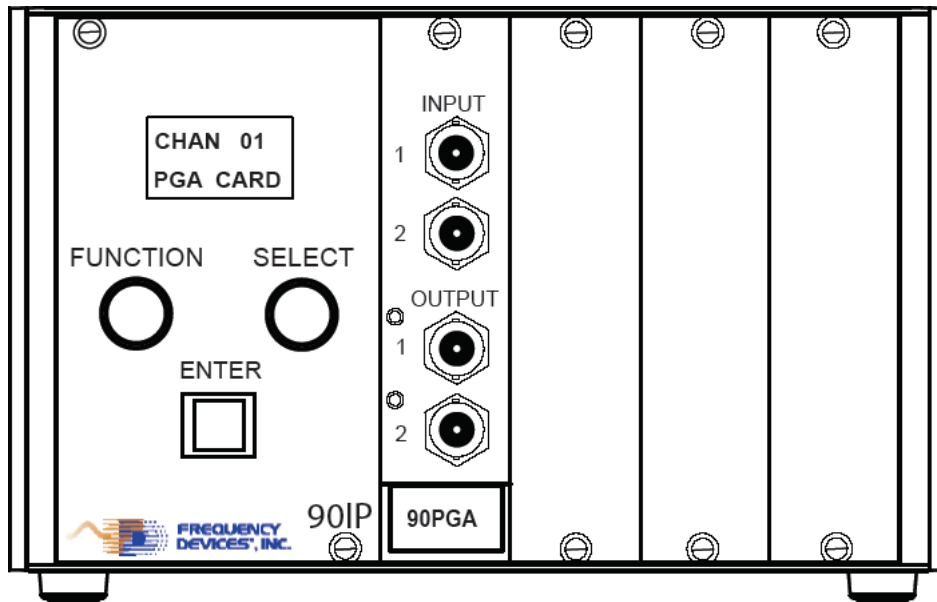


Figure 1 – Front Panel

1.2 - 90 PGA Operation Instructions

1. Upon power up, a cursor appears under the default function value or mode. (Note the cursor is always initially displayed on the LSB of any numerical value.)
2. Turning the **FUNCTION** knob scrolls the cursor through the various function selections.
3. To make a change, press the **ENTER** button and the addressed character will blink.
4. Turning the **SELECT** knob will alter the value of the desired character or mode.
5. Pressing the **ENTER** button again, loads the selected value or configuration into the slot card and controller memory and the blinking stops.
6. After a **value** is accepted by pressing the **ENTER** key, another function value or mode may be selected by using the **FUNCTION** and **SELECT** knobs.
7. Once the channel is programmed or configured, it may also be saved in one of the nine configuration locations. Since it is the most recent configuration setting, it automatically becomes the new power-up default for that channel.
8. User must press **ENTER** button to select and activate all configurations. This is done on a per channel basis.



Section 1 Front Panel Operation

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90PGA slot cards can be addressed from either the 90IP hard front panel or by using a computer controlled soft front panel via the GPIB or RS232 communication port on the rear of the 90IP chassis. See page 7 for Remote Operation instructions.

Operating functions with available ranges or acceptable modes are listed below in the command structure listing.

1.3 - Front Panel Command Structure

1. ADD – Identifies current chassis location within the GPIB communication system structure. For individual chassis, the default address reads “01”.

ADD	00 thru 30
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2. SLOT – Each 90IP chassis can be populated with one (1) to four (4) slot cards. This command allows the user to independently select and configure each slot card.

SLOT	1 thru 4
-------------	----------

3. CHAN – Each 90PGA slot card contains two (2) channels of programmable gain. The CHAN command allows the user to independently select and configure each 90PGA channel.

CHAN	01 or 02
-------------	----------

4. MODE – Determines coupling requirements and single-ended or differential types for the input signal.

MODE	AC –AC coupled input	SNGL – Single Ended
	DC –DC coupled input	DIFF - Differential

Note: Output is always single ended.

5. GAIN – Gain selection is performed by setting each individual digit.

	<u>Tuning Range</u>	<u>Step</u>
GAIN	0 dB to 64.5 dB	0.5 dB

6. OFFSET – Offset is preset for every card at room temperature. Because of thermal drift and high gain settings, fine-tuning of DC offset is sometimes required. Offset adjustment is performed sequentially.

	<u>Tuning Range</u>	<u>Step</u>
OFFSET	-100 mV to 100 mV	1.0 mV

7. CONFIG – Up to 9 configurations can be saved on each 90PGA channel. Slot card configuration in use at time of power-OFF will be saved to the next power ON cycle. Enter **bolds** the **d** in saved.

CONFIG	Select 1 thru 9
	S - Saved

8. REMOTE – Displays Local reset screen when external computer has control of the instrument in remote operation. On power-up, Instrument defaults to local mode. During a remote session, press ENTR to return to local mode. Remote mode can only be initiated by an external computer.

	REMOTE
LCL - Local	ENTR – RS232 or GPIB

9. LED's – Each 90PGA contains one clipping section per channel for gain output. This output is the input into the clipping circuitry. The input passes through a comparator and when peak voltage is greater than +10.5 V or less than – 10.5V, **CLIPPING** occurs and the red LED's will light.

Note:
Outputs of the slot cards are always DC-Coupled.

2.1 –Directory Descriptions CDFC-04

The **CDFC-04, 90IP Function Cards Installation Disk** contains documents in Word and PDF formats that include the 90PGA data sheet and this User Manual. Also included are set-up directories for each function card user interface, the function cards driver, and the instrument control software. These set-up directories are:

1 – 90FC Instrument Driver (For Custom Applications)

This directory will install the code and the files needed to develop custom applications using the 90PGA or any other function cards available to date.

2 - 90IP Instrument Control

This directory will install the **LAUNCH SLOT CARD CONTROL** software and install the **90IP INSTRUMENT SLOT CARD CONTROLLER CONFIGURATION** software.

3 - 90PGA User Interface (For Custom GUI Development)

This directory installs the code and the files used in developing the **90PGA GUI**.

Note: Additional directories will depend on function cards available to date. These directories install the code and the files used in developing the function card GUI's for custom development.

Follow the process instructions to install any utility into a desired local directory. Each directory offers installation software for function card configuration tools such as the 90PGA. **Note that clicking on setup after installation uninstalls the software.**

CDFC-04 software uses the 90IP to start the configuration process through the communication interface (either GPIB or RS232). The 90PGA **Slot Card Controller (SCC)** is used to read and set the configuration of valid 90PGA cards.

The 90PGA, SCC performs the following functions:

- Provides communication with the controller interface,
- Provides slot card access,
- Provides slot card set-up, and
- Discontinues slot card operation (Stopping).

It is designed to allow the user to select the channel and gain parameters through the software front panel. By setting the values with the soft front panel, the software automatically configures the 90PGA card without the need to use the 90IP hard front panel instrument controls. For this to occur, the SCC monitors event changes in each soft panel control and runs various routines accordingly. Multiple slot cards may be arranged to work simultaneously without affecting each other.

2.2 – Installation and Set-Up

90PGA Remote Software Installation Details:

The (90IP / Slot Cards) installation tools use the Microsoft Windows Installer (MSI) technology to install the necessary 90IP-related software and development tools for remote operation. This software suite was developed using National Instruments' LabWindows/CVI Version 6.0 environment following rules established in the *VXIplug&play* instrument driver architecture and the IVI (Interchangeable Virtual Instrument) Foundation Standards. As such, certain libraries, drivers, and "software engines" are required in the recipient PC for the proper operation of the application software. This is true for either application end-users or software developers.

In the case of software developers, the installation of additional tools may depend on the development environment and/or any other tools needed to open/review or edit the development files supplied with the software suite. For users requiring remote operation every tool **MUST** be installed to be able to remotely operate the 90IP/Slot Cards.

The 90IP uses the following National Instruments' (NI) engines and drivers with their corresponding components:

1. NI-488.2 1.70- for applications using GPIB.
2. NI VISA 2.6 Run-time Engine – application programming interface (API) that defines interface-independent features and standards for instrument drivers.
3. IVI Engine 1.83 - the IVI engine is in the form of a 32-bit DLL. The IVI engine requires that you install VISA, but it is not dependent on any other library.
4. Measurement & Automation Explorer 2.2 - to provide devices access and to configure hardware and software.

The **CDFC-04, 90IP Function Cards Installation Disk** is provided for custom development and to install the application software needed for remote-ready operation. To install any of the software tools simply open the specific directory and start the setup procedure by clicking on the **Setup** icon. This starts the setup procedure.

Note that a canned FREQUENCY DEVICES GUI and launcher is provided with every slot card installation disk, from which remote operation of the 90IP and its slot cards may be possible. You may wish to print out a copy of the 90PGA Operations Manual.

Follow the instructions to install 90IP/90PGA utilities into a local directory:

- Insert the **CDFC-04** disk into your CD-ROM.
- Access the start-up (setup) executable either by using the Start/Run/Browse popup window or with Windows Explorer on your Windows operating system.
- Select the **90FC Instrument Driver** folder. Double-click on Setup.exe to install the **90IPxxx Function Cards Driver** software. Verify that files reside in the selected target PC directory.
- Select the **90PGA User Interface** folder. Double-click on Setup.exe to install the **90PGA User Interface** software. Verify that files reside in the selected target PC directory.
- Select the **90IP Instrument Control** folder. Double-click on Setup.exe to install the **90IP Instrument Control** software. If selected, a complete installation of the **90IP Instrument Control** software includes: NI-MAX 2.2.0, NI Remote Provider for MAX, NI Software Provider for MAX, NI-488.2 for Windows, NI GPIB Provider for MAX, NI-VISA 2.6 Run-time Engine, NI-VISA MAX Provider 2.6.1f2, NI-VISA Server 1.0.0f6, NI-IVI engine 1.83, NI-IVI Provider for MAX, and the 90IP-related software. Note that depending on the software/hardware conditions on the target PC you may want to run a custom installation and select only the features that are needed for remote operation. **CAUTION! Check (NO)** when the NI reboot windows appear

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during driver/libraries installation. Do not reboot until the end of the install procedure, where a single popup window prompts you for a restart. The installation process should not be interrupted with a reboot, otherwise installation must be re-started from the beginning.

- After installation and reboot, verify that the files reside in the selected target PC directory. An FDI icon should appear on you desktop. Note that verification of installed files after each step on the hard drive is optional.
- For serial remote operation: With the 90IP unit turned ON and the RS232 cable connected to COM1 or 2, RUN the NI-MAX 2.2.0 by clicking on the NI icon on the desktop, this updates the configurations. Wait for the data to be updated, indicated by no MAX or hard drive activity. Quit the MAX application window.
- Before initiating the remote mode for the 90IP, verify that it is powered up, connected to the PC Via the RS232 cable and that the display is not in remote mode. Initiate the 90IP Instrument Control from the FDI desktop icon: Select RS232, and COM1 or 2 on the 90IP GUI. Click on Scan and this operation will produce: ASRL<COM>::INSTR in the "Instruments" display window. Click on the items as they appear in the windows until the 90PGA GUI appears. Verify that remote control of the PGA card is functional (One can actually hear relays clicking for certain button changes in I/O). Note: When finished, remember to use the Quit button to exit the application. After quitting a remote session, press the ENTER button on the 90IP to return to local mode or turn the power button off and on, to reset the instrument.
- For GPIB remote operation: Connect a GPIB cable from the instrument to the PC, and turn on the 90IP as above.
- Initiate the 90IP Instrument Control from the desktop icon: Select **GPIB** then click on the Scan button: GPIB0::1::INSTR should appear in the "Instruments" display window. Click on items as they appear in the windows until the 90PGA GUI appears. Verify that control of the PGA card is functional. Use the Quit button to exit application.

Initiating "**SETUP**" will toggle between install and uninstall. To uninstall all the 90IP-related software from the target PC, you may use the same disks for uninstalling the **CDIP-04** and **CDFC-04** software. This is accomplished by initiating the CD setups from each folder, again. Each time this is done, the software toggles between install and uninstall. However, even though the NI libraries auto setup, they do not uninstall automatically. The NI libraries must be uninstalled separately using Add/Remove Programs in Control Panel. The list is as follows, NI IVI engine 1.83, NI-MAX 2.2.0, NI-488.2 1.70, NI VISA 2.6 Run-time Engine, and NI-VISA Server 1.0.0f6.

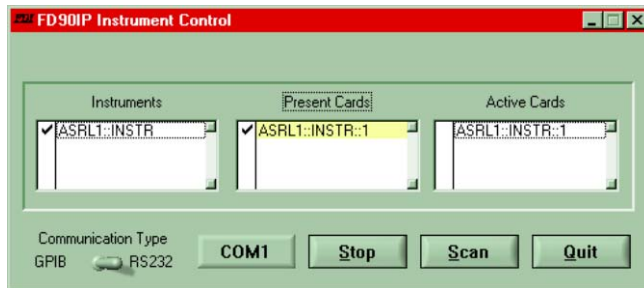
See Appendix A for **Windows 2000, Windows XP After Installation Considerations.**

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Set-Up: Remote Operation

1. Insert the **CDFC-04** CD into the PC CDROM. Using Microsoft Explorer, select the **Instrument Control Directory** and **“CLICK”** setup.
2. Follow instructions and the software will place an icon on your desktop and in your Program startup menu.
3. Connect the appropriate cable RS232 or GPIB to the PC's interface card and the 90IP.
4. **“DOUBLE CLICK”** on the 90IP icon and the instrument controller set up Graphical User Interface (GUI) will appear.
5. Select GPIB or RS232. For RS232, select the COM port (1 or 2) location where the RS232 interface card is installed in your PC.

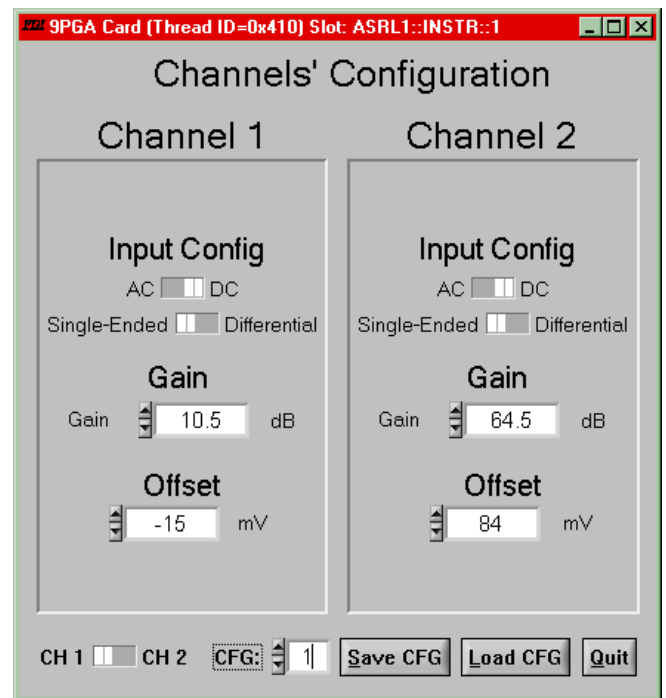


6. **“CLICK”** on **SCAN**, this will display an instrument list. **“CLICK”** or highlight the desired chassis, this will display an

To **Reactivate the Soft Front Panel** after shut down, steps four (4) through seven (7) of the above procedure (**Section 2.2**) must be performed.

instrument list of slot cards installed in the 90IP chassis.

7. **“CLICK”** or highlight a slot card, this will launch the slot card GUI onto the PC screen, allowing set-up of each channel configuration on the slot card. At power down, the GUI will show the last used settings of the slot card.



See **Figure 2** and read **Section 2.6** for a detailed description of the above commands.

2.3 - Slot Card Command Reference

For 90PGA slot card drivers see **Set-Up Disk CDFC-04, Frequency Devices FD90IPxxx Cards Reference Document**. This document includes the commands, syntax, parameters, expected return values, and error codes to consider when developing a software system using the instrument driver to configure the 90PGA card or any other valid function card. **CDFC-04** also contains **Frequency Devices 90IP/PGA Card Online Help**.

2.3 1 - Command Syntax and Format

To communicate with the 90IP, use ASCII characters. The commands must be issued in **UPPER CASE ONLY** and **cannot** contain any number of embedded space characters. A command to the 90IP consists of a command mnemonic with optional ?, optional =, arguments if necessary, and a command terminator. In RS232, the command terminator is a <lf> (line feed) or (0A)x. In GPIB, the terminator is a linefeed <lf> or EOI. It is important to note that the command terminator is embedded automatically when issuing commands through GPIB. The user/developer need not worry about adding the command terminator to commands using GPIB. Example: You may need to “drop” the “\n” character from the string you are using as a command.

No command processing occurs until a command terminator is received. The commands are interpreted in the same way in either RS232 or GPIB. Values returned by the 90IP are sent as a string of ASCII characters terminated by <lf> (line feed) or (0A)x. **Table 1** shows examples of 90PGA commands

Command	Function
CUPL?\n	Query the coupling mode of the active card/channel.
SNGL\n	Set the active card/channel to single-ended output mode.
CARD=1\n	Set the card in slot one, “active” ¹ .
GAIN=10.5\n	Set the gain of the active card/channel to 10.5dB.

1. Active means to receive the focus. Every configuration command issued after this one will affect the card in the specified slot.

Table 1 - 90PGA Command Examples.

When a command is issued, the instrument controller writes a command to the 90IP first, and then reads the result from it. If the command is a valid query command, the 90IP will return the required information as a string of ASCII characters. For instrument parameter configuration commands, a hexadecimal number 00 is returned to show the controller that the command has been executed successfully. If an error occurs, a hexadecimal number 55 will be returned. All returned messages from the 90IP will terminate with a linefeed <lf> or (0A)x.

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Table 2 defines the 90PGA command set:

Note: The expected values are responses from the 90IP with no software driver processing.

Command	Function	Expected/Set to Value
IDN?	Returns a string representing the instrument's identification name.	"FreqDev,90IP\n"
GPIB?	Returns a string representing the instrument's GPIB primary address.	A value from 00 to 30.
WHO?	Returns a string list representing the cards present in the 90IP slots. The list will show every card properly inserted into a slot and loaded into the 90IP.	"CARD 1,2,3,4\n" for a fully loaded 90IP.
CARD?	Returns a string representing the active card type.	"2 CHAN PGA\n" for a 2 channel amplifier type card.
GAIN?	Returns a string value representing the active card/channel gain setting.	A value from 00.0dB to 64.5dB in 0.5dB increments.
CUPL?	Returns a string representing the active card coupling mode setting.	"AC\n" coupled or "DC\n" coupled.
INPUT?	Returns a string representing the active card input mode setting.	"SNGL\n" single-ended or "DIFF\n" differential-ended.
OFFSET?	Returns a string value representing the active card DC offset setting.	A value from "-100mV" to "100 mV", for example: "-05 mV", "09 mV", "10 mV", etc.
DC	Sets the coupling mode of an active card channel to DC.	Set DC coupled mode.
AC	Sets the coupling mode of an active card channel to AC.	Set AC coupled mode.
SNGL	Sets the input mode of an active card channel to single-ended.	Set the current channel to the single-ended mode.
DIFF	Sets the input mode of an active card channel to differential-ended.	Set the current channel to the differential-ended mode.
CARD=n	Selects an active card.	Select a card where n is 1, 2, 3 or 4.
CHAN=n ² (See note)	Selects an active card channel.	Select a channel where n is 1 or 2.
GAIN=xy.z	Sets the gain of an active card channel.	Set the gain where x can be any number from 0 to 6, y can be any number from 0 to 9 and z is 0 or 5. NOTES: x cannot be a leading zero, x may be dropped, and y and z must always exist.
SAV=n	Saves the parameter settings of a card/channel to a specific configuration from a list of configurations. This set will contain the active card/channel parameter value settings.	Save current parameters into a configuration where n is a value from 1 to 9.
OFFSET=sxyy	Sets the dc offset of an active card channel.	Set the offset where s is the sign NOT used in positive numbers, x is a number from 0 to 1, and y is a number from 0 to 9. Numbers are left justified. Leading zeroes may be dropped.
CFG=n	Initializes the parameters of a card/channel to a specific configuration from a list of configurations. This set will configure the active card/channel.	Restore parameters from a configuration into active card parameters where n is a value from 1 to 9.

2. NOTE: "CHAN?" is undefined for the 90PGA slot card.

Table 2 – 90PGA Command Set

2.4 - Main Soft Front Panel

The components of the main panel are shown in **Figure 2**:

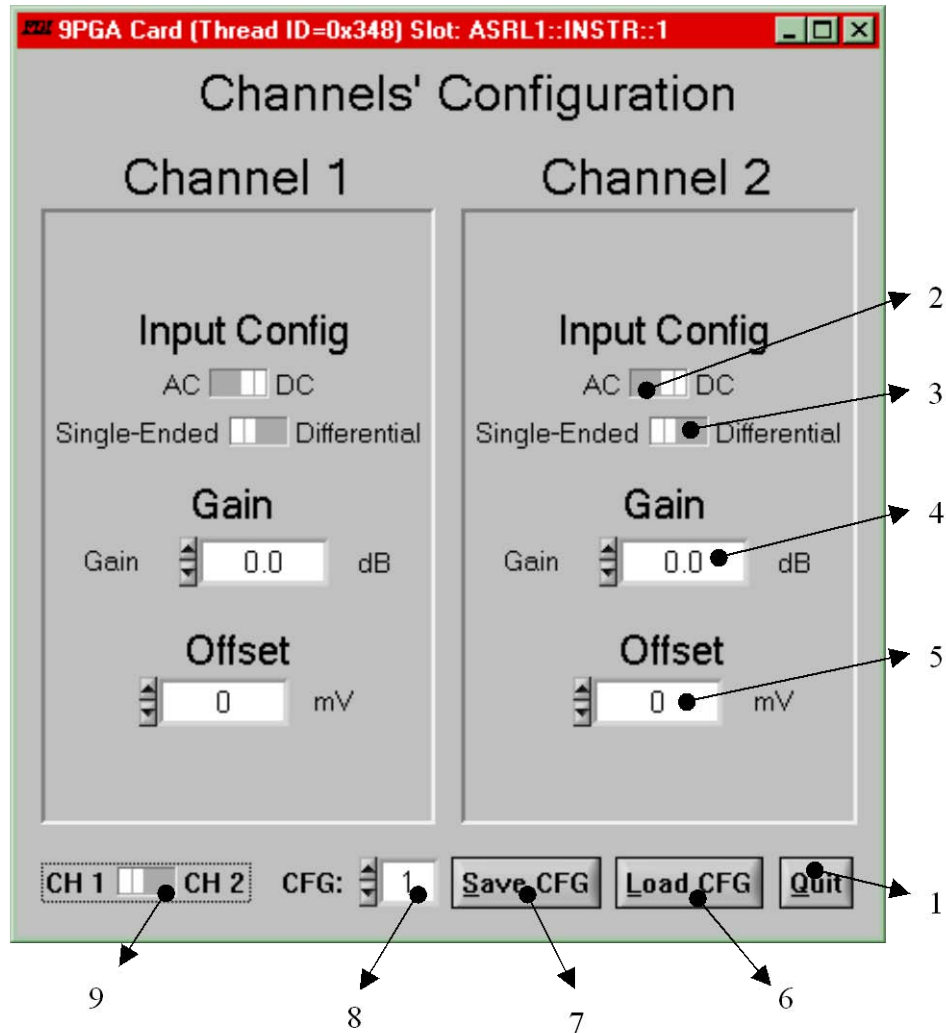


Figure 2 - Components of the Soft Front Panel.

2.5 - Functional Command & Configuration

The main panel is divided into two functional groups: Command, and Configuration. The **Command Group** allows the user to initiate certain process/system commands. The **Configuration Control Group** contains the controls necessary to set different configuration parameters into the 90PGA.

Command Group

1 - Quit Command Button: Use this command button whenever you want to exit/close the software. It will then no longer allow configuration changes; close the function card panel and turn-off the SCC without affecting any other active slot card process.

Configuration Control Group

Input Configuration Controls: Use these controls to select the input configuration modes for the slot card.

2 – Coupling Mode Selection: Set the coupling mode for each channel in the function card with the AC/DC control. Select **AC** for AC coupling mode or **DC** for DC coupling mode.

3 – Input Mode Selection: Sets the input mode for each channel in the slot card. Select **Single-Ended** for single-ended input operation or **Differential** for differential input mode.

4 – Gain Control: This control sets the gain (0 to 64.5 in 0.5dB steps) for each channel on the slot card.

5 - Offset Control: This control sets the signal DC offset value (-100 to 100 in 1mV steps) for each channel on the slot card.

6 – Load CFG Control: Use this command button to load a selected configuration from a selected slot card channel. This will load **ONLY** the configuration parameters for the selected channel/configuration pair. After loading the specified configuration, the display indicators representing the configuration parameters for the selected channel will be refreshed. Allow a ten (10) second delay for refreshing of the GUI.

7 – Save CFG Control: Use this command button to save a selected configuration from a selected slot card channel. This will save **ONLY** the configuration parameters for the selected channel/configuration pair.

8 – CFG Control: Use this control to set the desired configuration number. Numbers go from one (1) up to nine (9) inclusive.

9 – CH 1 - CH 2 Control: Use this control to select the channel to be used in the saving (Save CFG) or loading (Load CFG) configuration operations. This control is **ONLY** used for configuration selection purposes.



Windows NT, Windows 2000, Windows XP Post Install Issues

Condition: When FDI's 90PGA application software reports the inability of a specific set of libraries and files to load and be used in the remote operation of the 90IP unit. Certain users are not allowed to run the FD90IP Application Software.

Cause:

Conditions are created by one of the key features of the operating system used. W2000/NT/XP systems, work under a very strict permission-controlled hierarchy of groups and users among other things.

The ability of an administrator to "fully operate" the system is because Administrators have "full control" of all the necessary libraries and files and non-administrative users do not. By not having the proper access rights to files and sufficient privileges for the libraries, registry keys, etc., the common users may be unable to remotely operate the 90IP chassis with the application software.

Solution:

The specific user must have the right privileges to access the necessary files. The user must have the proper access to open the registry keys opened by specific libraries. What follows is a set of guidelines **suggesting** a way to allow any desired user to acquire the necessary privileges to run the FD90IP Application Software.

Perform the following steps in order to grant the necessary privileges to the user:

As an administrator (before the installation):

The account that installs the software must have administrator privileges.

If tight security is not an issue in the users computer system, consider elevating the system privileges. You are referred to <http://msdn.microsoft.com/library> for more information on the subject. This will enable a user to run the installation and have it work regardless of privileges.

As an administrator (after the installation):

Notes:

- The account (with administrator privileges) that installed the software receives full control of the 90IP-related software.
 - If common users will use the application software, it is recommended for the administrator not to run anything after installation. For example, the user should run the MAX utility.
 - (Windows XP) The PC must NOT be in "simple file sharing mode".
1. Start **regedt32.exe** to run the registry editor.
 2. Click on the **HKEY_LOCAL_MACHINE on Local Machine** window.
 3. With the browser, locate the following directory: **HKEY_LOCAL_MACHINE\SOFTWARE\National Instruments**.
 4. On the Menu bar, click on **Security** and then click on **Permissions**. (Windows XP: Right click on **National Instruments** and select **Permissions...**)
 5. On the **Permissions for National Instruments** window, select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**.



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6. With the browser, locate the following directory:
HKEY_LOCAL_MACHINE\SOFTWARE\VXIPNP_Alliance
7. On the Menu bar, click on **Security** and then click on **Permissions**. (Windows XP: Right click on **VXIPNP_Alliance** and select **Permissions...**)
8. On the **Permissions for VXIPNP_Alliance** window, select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**.
9. Close the registry editor.
10. Go to the **C:\Program Files** directory.
11. Right click on the **National Instruments** folder and select **Properties** from the popup menu. Click the **Security** tab on the **National Instruments Properties** window. Select the **Users** group and allow modify and write control by checking on the **Modify** box and the **Write** box. Click **OK**.
12. Right click on the **90IP** folder and select **Properties** from the popup menu. Click the **Security** tab on the **90IP** window. Select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**.
13. Right click on the **90PGA** folder and select **Properties** from the popup menu. Click the **Security** tab on the **90PGA** window. Select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**.
14. Go to the **C:\Documents and Settings\All Users\Start Menu\Programs** directory.
15. Right click on the **90IP Instrument Control** folder and select **Properties** from the popup menu. Click the **Security** tab on the **90IP Instrument Control** window. Select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**. Repeat for **FD90IpxxxDriver Help** folder and files, **FD90IPCNDriver** folder and files, and **National Instruments** folders and files.
16. Go to the **C:\Documents and Settings\All Users\Desktop** directory.
17. Right click on the **90IP Instrument Control** shortcut and select **Properties** from the popup menu. Click the **Security** tab on the **90IP Instrument Control** window. Select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**.
18. Right click on the **Measurement & Automation** shortcut and select **Properties** from the popup menu. Click the **Security** tab on the **Measurement & Automation** window. Select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**.
19. Go to the **C:\Program Files\90IP** directory. For each of the following subfolder and files inside do: Add **<USERSDOMAIN>Users** to the subfolder. Select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**.
 - a. **90IP User Interface**
 - b. **FD90IPCNDriver**
 - c. **FD90IpxxxDriver**
 - d. **Instrument Control**
20. (For a developer User) Go to the **C:\Program Files\90PGA** directory. For each of the following subfolder and files inside do: Add **<USERSDOMAIN>\Users** to the subfolder. Select the **Users** group and allow full control by checking on the **Full Control** box. Click **OK**.
 - a. **90PGA User Interface** folder
 - b. **90PGAGUI** folder
 - c. **90PGA.c**
 - d. **90PGA.h**
 - e. **90PGA.uir**
 - f. **FD90Ipxxx.fp**
 - g. **Variables.h**
21. **LOG OUT**.



As a User:

1. Double-click on the **MAX** icon to run it.
2. Refresh the configuration tree by clicking on **F5** while the focus is on the **MAX** window.
3. Double-click on the 90IP Application Software icon. Remotely operate the 90IP unit and function cards.