RCP 2.X

Users' Guide

MAGNETEK
MATERIAL HANDLING

Part Number: 178-01702-0010 R3
May 2014

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2 Preface and Safety

2.1 Product Safety Information

Magnetek, Inc. (Magnetek) offers a broad range of radio remote control products, control products and adjustable frequency drives, industrial braking systems, and power delivery products for material handling applications. This manual has been prepared by Magnetek to provide information and recommendations for the installation, use, operation and service of Magnetek's material handling products and systems (Magnetek Products). Anyone who uses, operates, maintains, services, installs or owns Magnetek Products should know, understand and follow the instructions and safety recommendations in this manual for Magnetek Products.

The recommendations in this manual do not take precedence over any of the following requirements relating to cranes, hoists, lifting devices or other equipment which use or include Magnetek Products:

- Instructions, manuals, and safety warnings of the manufacturers of the equipment where the Magnetek Products are used,
- Plant safety rules and procedures of the employers and the owners of the facilities where the Magnetek Products are being used,
- Regulations issued by the Occupational Health and Safety Administration (OSHA),
- Applicable local, state, provincial, or federal codes, ordinances, standards and requirements, or
- Safety standards and practices for the industries in which Magnetek Products are used.

This manual does not include or address the specific instructions and safety warnings of these manufacturers or any of the other requirements listed above. It is the responsibility of the owners, users and operators of the Magnetek Products to know, understand and follow all of these requirements. It is the responsibility of the employer to make its employees aware of all of the above listed requirements and to make certain that all operators are properly trained.

No one should use Magnetek Products prior to becoming familiar with and being trained in these requirements and the instructions and safety recommendations for this manual.

2.2 Product Warranty Information

Magnetek, hereafter referred to as Company, assumes no responsibility for improper programming or operation of a device (such as a drive or radio) by untrained personnel. A device should only be programmed or operated by a trained technician who has read and understands the contents of the relevant manual(s). Improper programming or operation of a device can lead to unexpected, undesirable, or unsafe operation or performance of the device. This may result in damage to equipment or personal injury. Company shall not be liable for economic loss, property damage, or other consequential damages or physical injury sustained by the purchaser or by any third party as a result of such programming or operation. Company neither assumes nor authorizes any other person to assume for Company any other liability in connection with the sale or use of this product.

For information on Magnetek's product warranties by product type, please visit www.magnetek.com.

2.3 WARNING, CAUTION, and *NOTE* Statements

Read and understand this manual before installing, operating, or servicing this product. Install the product according to this manual and local codes.

The following conventions indicate safety messages in this manual. Failure to heed these messages could cause fatal injury or damage products and related equipment and systems.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTE: A NOTE statement is used to declare installation, operation, programming, or maintenance information that is important, but not hazard-related.

3 Introduction

3.1 Overview

NOTE: Please refer to the specific product manuals for telePilot, telePendant and inteleSmart usage.

The Radio Control Programmer (RCP) is a user-friendly, Windows® based, interactive radio control programmer software. It is designed for communication from your PC to Magnetek radio control products.

The USB RCP Kit (Part# 178-01702-0200) contains the following components:

1. USB drive containing RCP Software
2. USB Cable
3. Activation Code

3.2 Supported Products

3.2.1 Supported Transmitters

- *tele*Pilot
- *tele*Pendant
- MBT
- PGT
- Mini PGT
- Mini MBT
- XLTX
- MLTX2
- Flex VUE™
- CHTX

3.2.2 Supported Receivers

- in*tele*Smart
- in*tele*Smart2
- MHR
- MHC
- CAN-2
- WIC-2402

3.3 PC Requirements

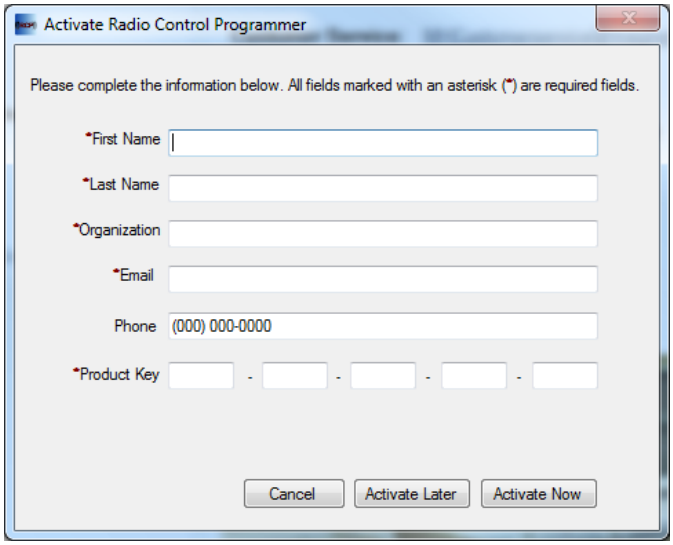
- Windows XP (Service Pack 3 or later)
    - PC with 800MHz processor or better with at least 256 MB of RAM and 100 MB of hard disk space.
- Windows Vista Basic, Home Premium, Business, or Ultimate (Service Pack 2)
    - PC with 800MHz 32-bit (x86) or 64-bit (x64) processor or better with at least 512MB of RAM and 20 GB hard drive.
- Windows 7 Home Premium, Professional, Enterprise, Ultimate
    - PC with 800MHz 32-bit (x86) or 64-bit (x64) processor or better with at least 512MB of RAM and 20 GB hard drive.
- USB port, mouse (or other pointing device), and keyboard.
- Internet Connection (for product activation only).

4 Installation

Insert the USB flash drive containing RCP 2.x into a USB port on your PC. Navigate to the flash drive and locate the RCPSetup.msi file. Double clicking this file will start the install process. When the installation is complete, RCP will be installed on your PC.

4.1 Run the RCP Software

After installation of the RCP Software, double-click the RCP icon found on the desktop to launch the program. This will prompt you to enter an activation key. If an activation key is not entered at this time, the software can only be used 10 times before locking the user out. Contact customer service or your sales representative for an activation key.



4.2 Software Updates

Additional features and bug fixes may be available from time to time. These may be downloaded from the Magnetek website.

4.3 Software Removal

To remove the RCP Software, open the control panel's "Add/Remove Programs" dialog box (Windows XP) or "Programs & Features" dialog box (Windows 7), double-click the Radio Control Programmer entry and choose Remove All from the dialog box.

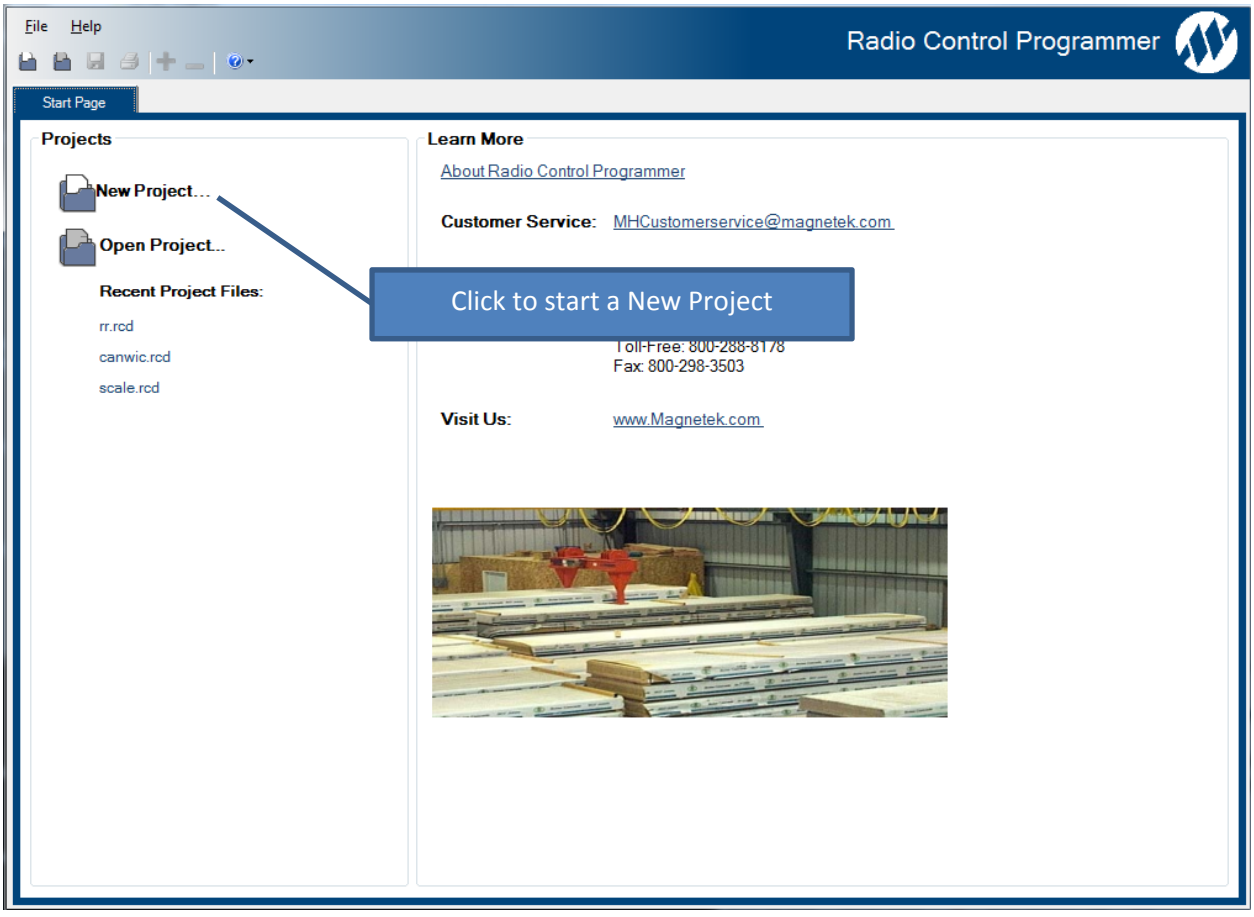
5 Getting Started

5.1 Start Page

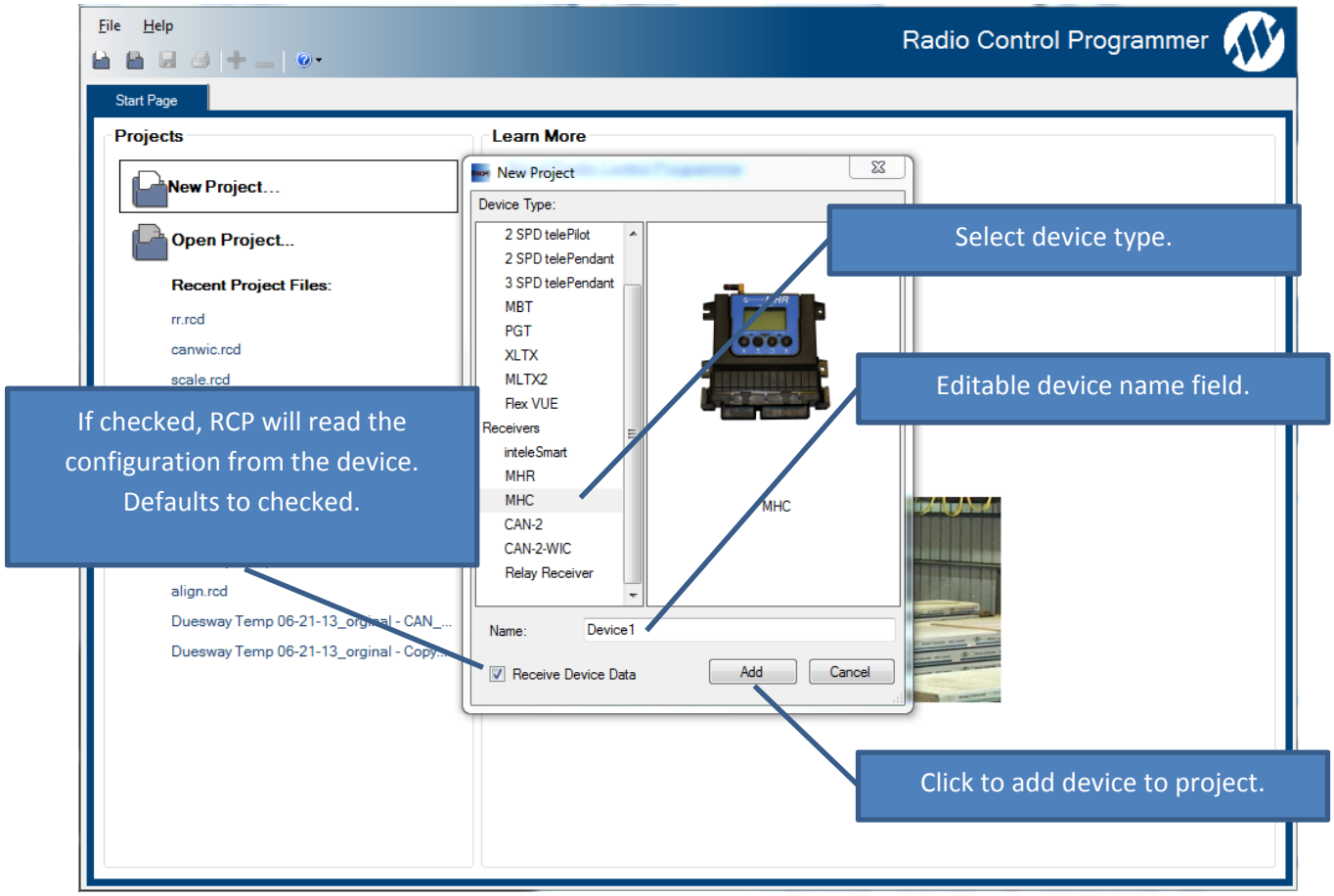
After the software has been activated, upon starting the user will see the Start Page. This is where new projects are created or existing projects are opened. This page also contains information on how to contact Magnetek.

5.1.1 Creating a New Project

To create a new project, click on the “New Project…” button on the Start Page.



After clicking this, a new dialog will pop up, prompting the user to choose the type of device they would like to add to the project. This lists all of the devices supported by RCP. Select the device type to add to the project.



After selecting the device type, the user then has the ability to give the device a name. The device name is solely used within RCP to help denote different devices within a project. Certain devices support the ability to receive the device data upon being added to the project. If a device does not support this, then the option will be greyed out.

A project can be created either with the device connected or without a device connected. If a project is created with a device connected, then RCP will read all of the configuration information from the device when the project is created (if the Receive Device Data box is checked). Having this box checked and the device connected is recommended as it gives the user a starting point with configuration. If the user chooses not to receive the device data or there is no device connected, then the current device configuration is unknown by the program. The user MUST be aware of this as certain device configuration parameters will be overwritten by the program defaults when the programming is "sent" to the device. This could mean that parameters such as the access code and RF channel are changed and a transmitter and receiver originally intended to communicate with each other will no longer communicate.

CAUTION

ALWAYS BE AWARE OF THE CONFIGURATION OF A DEVICE. NOT HAVING THE LATEST CONFIGURATION HAS THE POTENTIAL TO PREVENT DEVICES INTENDED TO COMMUNICATE TOGETHER FROM BEING ABLE TO COMMUNICATE.

When the “Add” button is clicked you will see a popup that shows the progress of reading the device data. When the read is complete click “Close” to continue.

5.1.2 Opening an Existing Project

Select “Open Project…” if you want to retrieve an existing program file. A list of recent projects also appears under the Recent Project Files. Clicking on one of these will open that project. It is recommended that you create a folder in which to save all programming files. When opening an existing project the user interface will automatically navigate to the last page that was visible when the project was saved.

CAUTION

TO PROGRAM OR READ DATA FROM THE DEVICE, THE DEVICE MUST BE TURNED ON AND CONNECTED VIA USB.

An existing project can be opened and modified without a device being connected. Doing this permits a program to be modified offline and a device programmed at a later time.

5.1.3 Recent Project Files

Recently opened or saved project files are listed under the “Recent Project Files:” heading. This gives the user a quick way to access project files. Clicking on the project name will automatically open the project and all of the devices within the project.

If the project file has been deleted or moved from the location where RCP saved it, then RCP will show an error if that project is clicked on. The error window will indicate that the project is unable to be opened and ask if the user would like to remove the reference from the “Recent List”. Clicking yes will only remove the reference from the list; it will not delete the file.

5.2 Toolbar Menu Items

5.2.1 Saving a Project

To save a project, click the File menu at the top of the RCP screen to open the dropdown menu. The user is then able to select “Save Project” or “Save Project As…” If this is a new project, clicking on “Save Project” will open a dialog box prompting for the file location and name. If this is an existing project, then clicking “Save Project” will save the project under the existing file name. Clicking “Save Project As…” will permit the user to save the project under a different file name.

Saving the project can also be done using the  icon in the toolbar across the top.

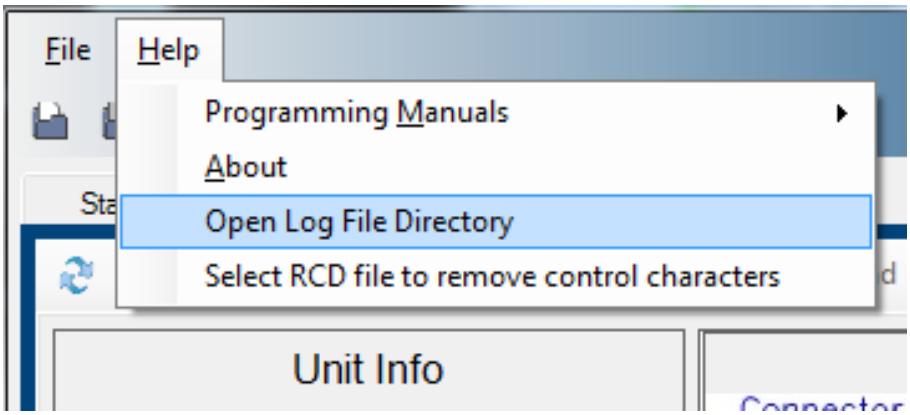
5.2.2 Reading the RCP Software Version

1. Select “Help -> About”.
2. The RCP Software Version number will be displayed.

5.2.3 Open Log File Directory

Should customer service need to be contacted for a problem with RCP, the user may be asked to send a log file to assist in determining what the problem might be. The log file contains debug information that will assist the factory in determining what the problem is.

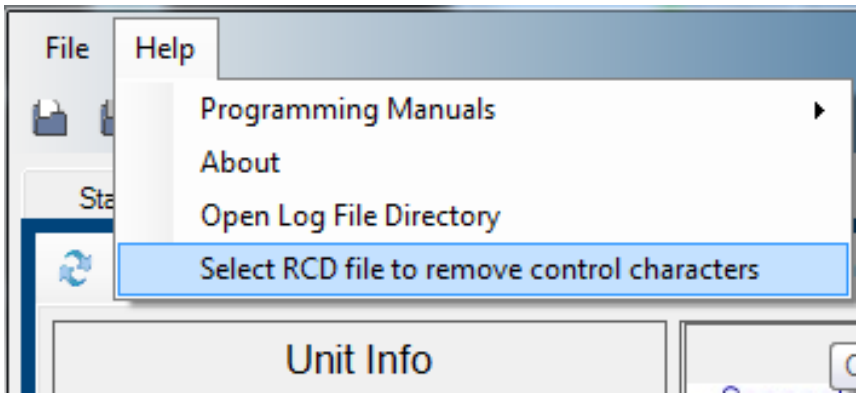
1. Select “Help -> Open Log File Directory”.
2. This allows the user to easily find the log file when sending it to customer service if there is an issue. This opens an explorer window so the user can drag the log file into their email client when sending it to customer service.



5.2.4 Removing control characters from the project file

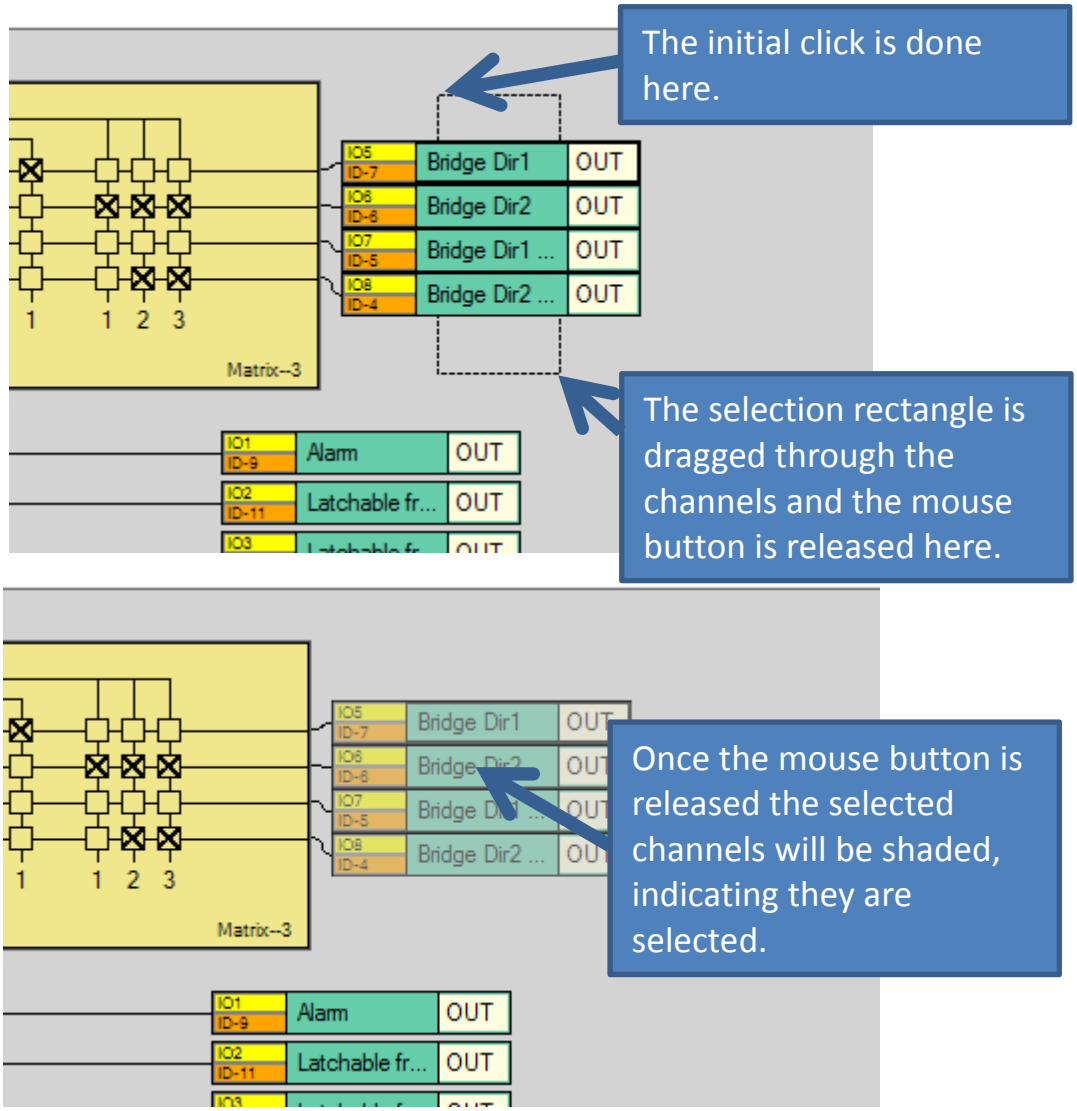
The 2.X version of RCP will prevent control characters from being written to the project file. A control character is a non-printable character that is not represented with a written symbol. This feature can be used if for some reason the RCD project file contains control characters. If the project file contains control characters, RCP will display an error when trying to open the project file. If this occurs, run this on the project file to remove the characters, and then reopen the project file; it will then load without error.

1. Select “Help -> Select RCD file to remove control characters”.
2. When removal is complete you will be notified.



5.2.5 Multi-Select

Multiple channels in the workspace can be selected using the cursor to create a selection rectangle. The selection rectangle is created by clicking an unoccupied area in the workspace, then dragging the mouse so the desired channels intersect with the selection rectangle. The selection rectangle does not have to encompass the entire channel.



The selected items can be moved as a group around the workspace, or the user can right-click on a single item or selected group to delete or copy.

5.2.6 Right Click Options

Items in the workspace can be right-clicked on to display a list of actions to be performed on the channel(s) selected. These options change depending on the selection.

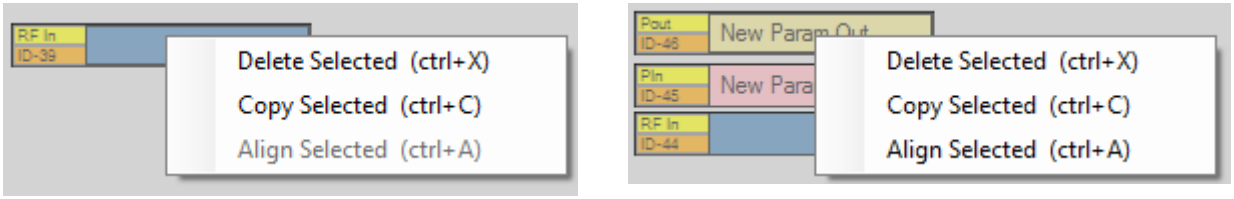


Figure 1: Single item right click vs. Multi item right click

Delete Channel: Clicking this item in the list removes the channel from the workspace.

Copy Channel: Creates a copy of the channel type that was clicked. No data is copied to the new channel, just the type of channel.

After the copy is complete, the newly created items are selected so they can be moved around as a group.

If multiple channels are selected then the “Copy Selected” option would copy the selected block of channels, and the “Delete Selected” option would remove the selected block from the workspace.

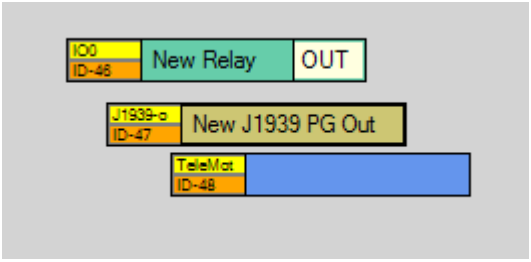


Figure 2: Prior to alignment.

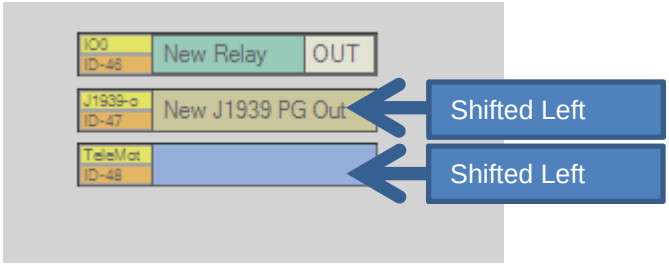


Figure 3: After alignment.

Align channel: Aligns the channels to the left-most channels in the group of selected channels. In the diagram above the lower two channels would shift left and be vertically aligned with the top channel. This menu item is disabled unless there are multiple channels selected.

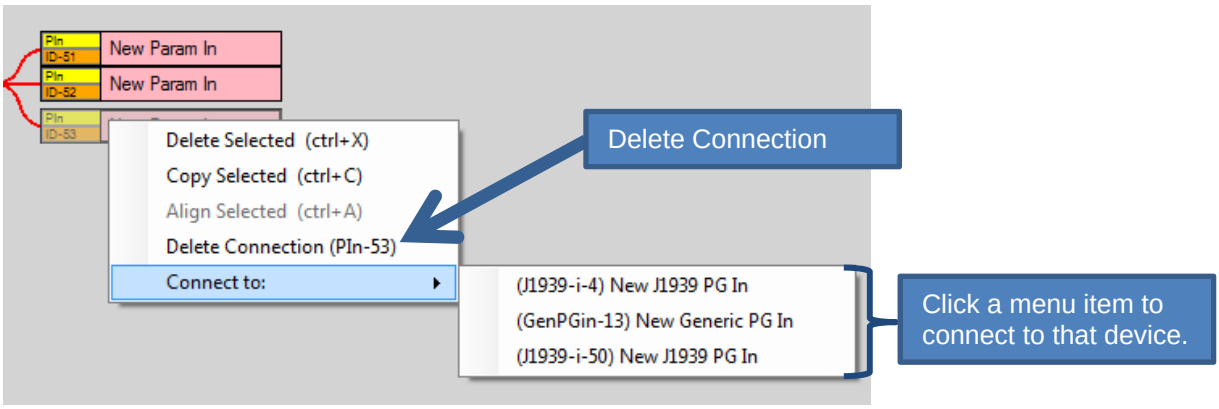


Figure 4: Right click connection options

Delete Connection: Clicking this option deletes the input connection coming in the left hand side of the channel.

Connect to: Connects the selected channel to the input side of the channel. Not all channels support right-click connection completion.

Table 1: Hot Key Sequences

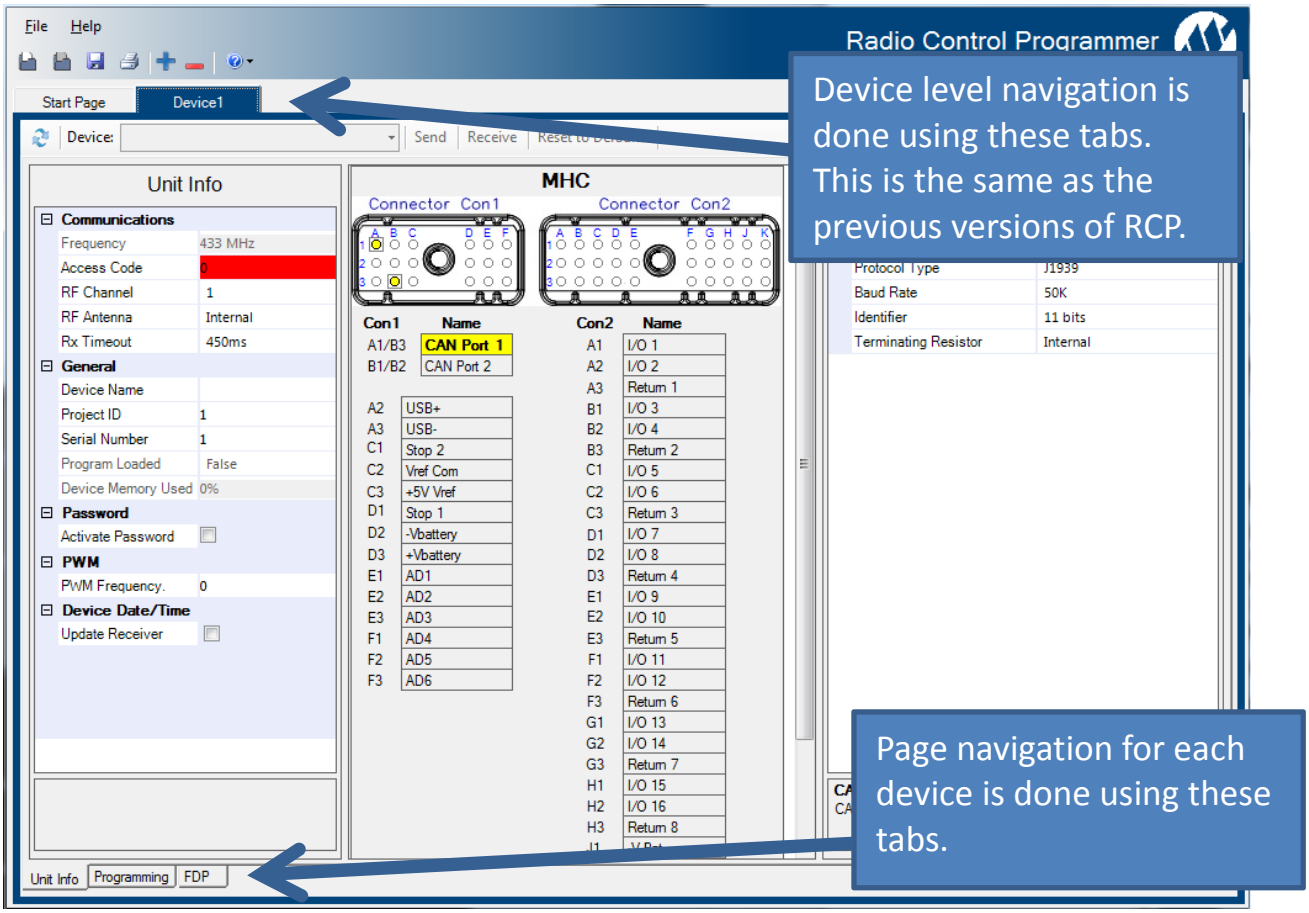
Key Combination	Description
Crtl+C	Copy selected channel(s) in the workspace.
Ctrl+X	Delete selected channel(s) in the workspace.
Ctrl+A	Vertically align the selected channels in the workspace.
Ctrl+Shift+A	Automatically moves any channels that have a negative x y coordinate to zero. This can occur if the channel group is moved and one of the channels could be moved out of the workspace.
Crtl+S	Saves the project.
Ctrl+(Left Mouse Click)	Adds the clicked channel to the selected group if the channel is not in the group. Removes the clicked channel from the selected group if the channel is selected.

6 Devices

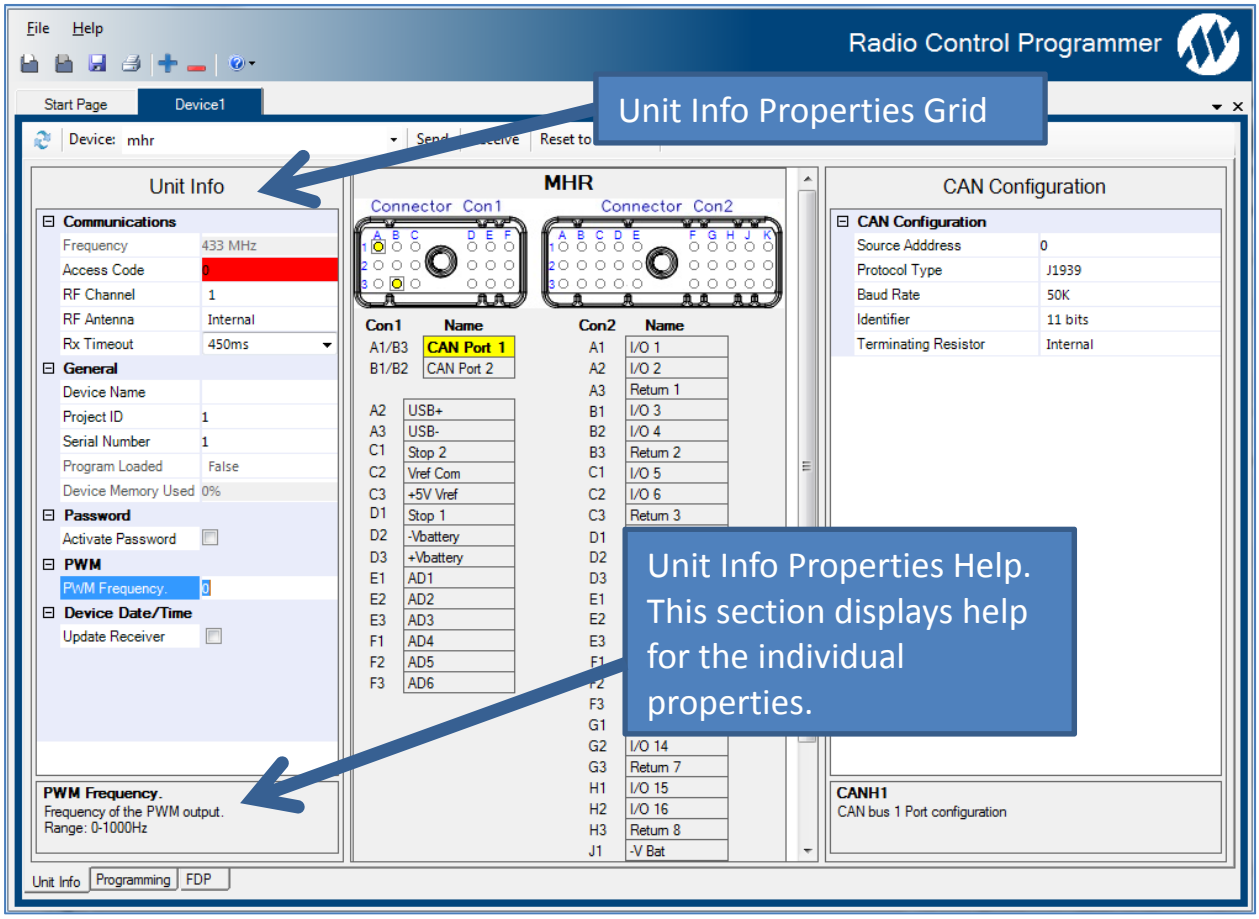
A device is the physical piece of hardware that is being programmed, which can be either a transmitter or receiver. Multiple devices may be added to a given project, making the project a collection of devices. The ability to have multiple devices within a project permits the user to easily switch between the various devices in order to see the different configurations and programming of related devices.

The first device is automatically added to the project upon creation of the project. Other devices can be added to the project by clicking on the File menu and choosing “Add” -> “New Device…” This will bring up a new dialog menu permitting the user to choose another device to add to the project.

The user interface and available device configuration tabs will vary between different device types. The screenshot below shows the properties for an MHR. Most Magnetek devices will have similar properties.



6.1 Unit Info Tab



The Unit Info Tab allows various I/O level changes to the device. The properties that can be modified will vary based upon the device type. Table 2: Unit Info Properties shows the availability of properties per device type, while Table 3: Unit Info Field DescriptionsTable 3 gives a detailed description of each of the properties.

NOTE: Changing any of these details will require a reboot of the attached device after the new information has been sent to the device for the change to take effect.

Table 2: Unit Info Properties

	MHR/MHC	CAN-2/WIC-2402	in*tele*Smart2
Frequency	Read Only	Read Only	Read Only
Access Code	X	X	X
RF Channel	X	X	X
RF Antenna	X	X	X
Rx Timeout	X	X	X
Client/Server	N/A	WIC-2402 Only	N/A
Device Name	X	X	X
Project ID	Read Only	Read Only	Read Only
Serial Number	Read Only	Read Only	Read Only
Device Memory Used	Read Only	Read Only	Read Only
Expansion Board 1	N/A	N/A	Read Only
Expansion Board 2	N/A	N/A	Read Only
Program Loaded	Read Only	Read Only	Read Only
Activate Password	X	N/A	N/A
PWM Frequency	X	N/A	N/A
Update Date/Time	X	N/A	N/A
ESTOP Configuration	N/A	CAN-2 Only	N/A

NOTE: Some versions of RCP will permit the changing of the Project ID field. The factory will determine if a user is eligible for a version with this ability.

Table 3: Unit Info Field Descriptions

Field	Description
Frequency	A read-only property displaying the Radio Frequency of the device. This is set by the factory and hardware configuration, and cannot be modified by the user.
Access Code	The access code acts as the receiver address. The receiver will only listen to transmitters with the same access code. *NOTE: The transmitter must be set with the same access code as the receiver to properly communicate with each other.* Range: 1-1048575
RF Channel	The RF channel is user-selectable through the pull-down menu. This function is used to prevent interference with other radio devices. Refer to Section 8 for additional information on channels and the exact frequency for each frequency range. Depending upon the installation, there might be special frequency channels shown.
RF Antenna	This section allows the user to select between utilizing the internal antenna that is built into the receiver or utilize the external antenna attachment (if available). The antenna selection can be Internal or External (if supported).
Rx Timeout	The amount of time before the device shuts down after not receiving a message from the transmitter. Range: 450-3000ms
Client/Server	The operation mode of the WIC-2402 device. This field may be read-only if the device is pre-defined.
Device Name	The device name field allows the user to create a custom name for the receiver. The name can be up to 16 ASCII characters long.
Project ID	This section displays the Project ID for the device. The Project ID is set by the factory and cannot be modified by the user. Range: 1-65535
Serial Number	This section displays the serial number for the unit. The serial number of the unit is set by the factory and cannot be modified by the user.
Device Memory Used	A read-only property showing the percentage of memory allocated for custom mapping.
Expansion Board 1	A read-only field that displays the type of expansion board that is connected.
Expansion Board 2	A read-only field that displays the type of expansion board that is connected.
Program Loaded	A read-only property showing if a user-defined map is loaded in the system.

Activate Password	The password is used to restrict access to the configuration menu on the device. Having an active password prevents accidental changes to the device configuration. *NOTE: Please familiarize yourself with this section before programming the password.* The password default setting is to be disabled during initial programming by the RCP software. To enable password protection, check the box next to the phrase "Activate password." If you choose to enable the password function, you can create a new password by selecting a four digit numerical password using numbers from 0 to 9. Be sure to write this password down in a safe place for future reference.
PWM Frequency	The Pulse Width Modulation (PWM) Frequency is the frequency that the outputs will operate at when configured for either open loop or current compensated mode. This feature can be selected by the user using a range from 33 to 1000 Hz (Open loop) or 75 to 1000 Hz (Closed loop).
Update Date/Time	The user can match the device time to the PC time or choose to set a time other than the time on the PC.
ESTOP Configuration	This field allows the user to define how the ESTOP/Output pins are configured. • The pins can be configured as: o ESTOP1 - ESTOP2 o ESTOP1 - Digital Output 2 o Digital Output 1 - Digital Output 2

WARNING

THE ACCESS CODES IN THE RECEIVER ARE UNIQUE AND FACTORY PRESET. DO NOT CHANGE THESE ACCESS CODES UNLESS YOU ARE REPLACING AN EXISTING RECEIVER AND ITS ACCESS CODE. CHANGING THIS CODE COULD MAKE IT COMMON WITH ANOTHER RECEIVER ACCESS CODE, WHICH COULD MOVE OTHER EQUIPMENT. NO TWO SYSTEMS IN ANY LOCATION SHOULD EVER HAVE THE SAME ACCESS CODES INDEPENDENT OF FREQUENCY. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH, AND DAMAGE TO EQUIPMENT.

WARNING

ALWAYS REMEMBER TO STORE THE PASSWORD IN A SECURE LOCATION FOR ACCESS IF THE PASSWORD IS LOST OR FORGOTTEN. ONCE THE DEVICE IS PROGRAMMED WITH A PASSWORD, THERE IS NO WAY TO DEFEAT THE PASSWORD WITHOUT USING THE RCP SOFTWARE TO EITHER READ THE PASSWORD OR REPROGRAM A NEW PASSWORD.

WARNING

THIS PASSWORD FUNCTION IS NOT TO BE USED AS A SECURITY DEVICE. THE PURPOSE OF THIS FUNCTION IS TO PREVENT ACCIDENTAL CHANGES TO THE RECEIVER SETTINGS. THE BEST FORM OF SECURITY IS ALWAYS TO LOCK UP THE DEVICE WHEN NOT IN SERVICE. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

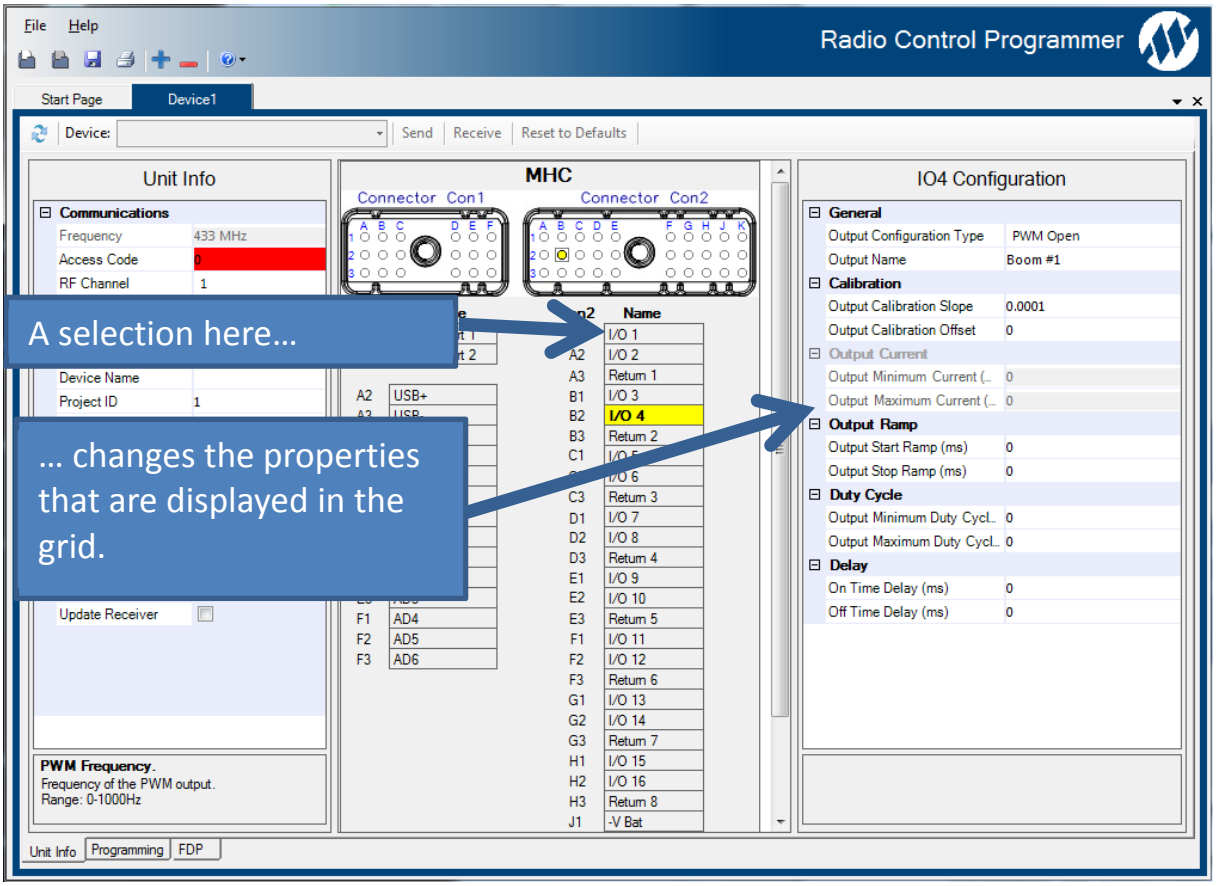
WARNING

NOT ENABLING THE PASSWORD FUNCTION ALLOWS THE DEVICE SETTINGS TO BE MODIFIED BY ANY UNAUTHORIZED USER(S). IMPROPER DEVICE SETTINGS COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

6.1.1 Device Block Diagram and Pin Properties Grid

The middle section of the Unit Info tab will display a block diagram of the device to be programmed. The block diagram is interactive and will change what is displayed in the pin properties grid on the right side.

In these screenshots the device being programmed is an MHR. For programmable devices the screen will have a similar layout.



When programming I/O (specific to devices that have configurable I/O),

Table 4 describes which parameters are configurable for each of the output types. These properties can be modified using the property grid.

Table 4: Available Properties Based on I/O Type

I/O	Type	Property					
		Min Current	Max Current	Start Ramp	Stop Ramp	Min Duty Cycle	Max Duty Cycle
Output	Digital Momentary	N/A	N/A	N/A	N/A	N/A	N/A
Output	Digital Latched	N/A	N/A	N/A	N/A	N/A	N/A
Output	PWM Open	N/A	N/A	X	X	X	X
Output	PWM Closed	X	X	X	X	N/A	N/A
Input	PWM	N/A	N/A	N/A	N/A	N/A	N/A
Input	Digital	N/A	N/A	N/A	N/A	N/A	N/A

6.1.2 CAN Configuration

For devices with configurable CAN, the figure below shows the selection of the CAN 1 bus and the grid changes to the configurable properties of the CAN bus. This allows the user to modify the CAN bus network communication settings by selecting which CAN bus to configure.

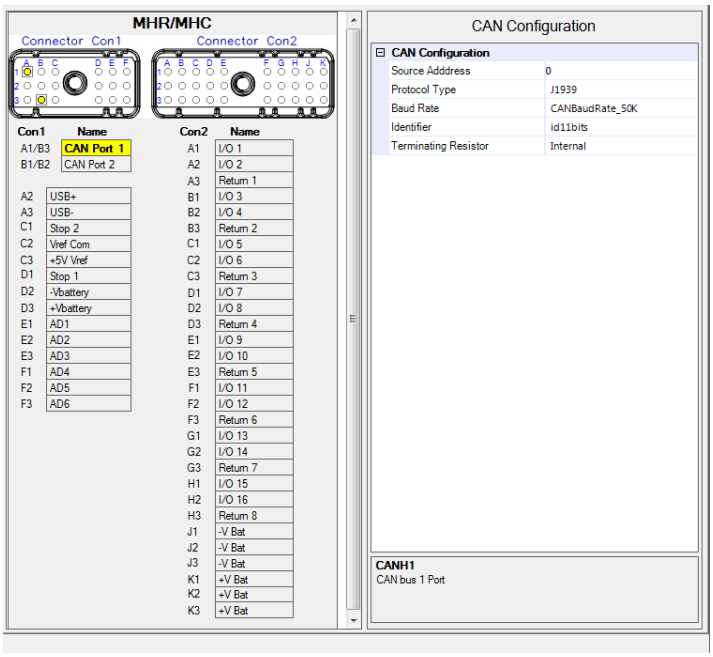


Figure 5: CAN1 Bus Configuration (MHR)

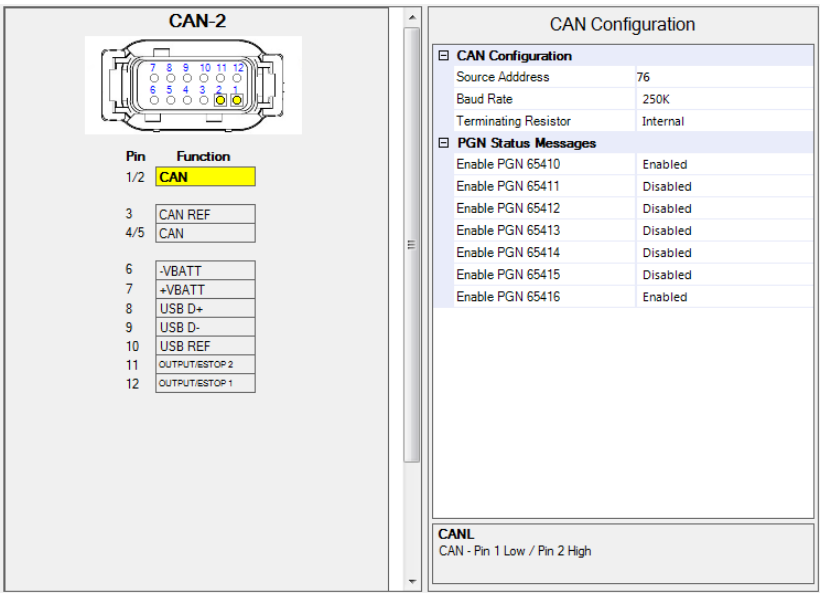


Figure 6: CAN Bus Configuration Page (CAN-2)

Table 5: CAN Configuration

CAN Field	Description
Source Address	This is the address that the device will use as the source address when transmitting messages on the CAN bus network.
Baud Rate	This pull-down menu allows the user to modify the communication speed of the CAN bus network. The user selectable options are 50k, 125k, 250k, and 500k.
Protocol Type	The protocol used to communicate on the CAN bus. Options: J1939/CAN Open/Parker ICP/High Country Tek DN/OEM Controls DN *NOTE: Not currently supported by any product.*
Identifier	The number of bits in the frame. Options: 11bits/29bits *NOTE: Not currently supported by any product.*
Terminating Resistor	Selects whether an internal terminating resistor or an external terminating resistor is used. Selecting Internal will enable the internal terminating resistor. Selecting External will disable the internal terminating resistor. *NOTE: Not all devices have the termination resistor set via software. This setting is only applicable to the devices that have this set via software. Please refer to the instruction manual for your device to determine how this setting can be modified.* Options: Internal/External
Enable PGN 65410	Enable/Disable Status PGN 65410 (Available in CAN-2 only). See Appendix A
Enable PGN 65411	Enable/Disable Status PGN 65411 (Available in CAN-2 only). See Appendix A
Enable PGN 65412	Enable/Disable Status PGN 65412 (Available in CAN-2 only). See Appendix A
Enable PGN 65413	Enable/Disable Status PGN 65413 (Available in CAN-2 only). See Appendix A

Enable PGN 65414	Enable/Disable Status PGN 65414 (Available in CAN-2 only). See Appendix A
Enable PGN 65415	Enable/Disable Status PGN 65415 (Available in CAN-2 only). See Appendix A
Enable PGN 65416	Enable/Disable Status PGN 65416 (Available in CAN-2 only). See Appendix A

6.1.3 Analog Input Configuration

For devices with configurable analog inputs, the following properties are configurable through the property grid if one of the analog inputs is selected.

Table 6: Analog Input Configuration

Analog Field	Description
Input Type (Analog/Digital)	Digital – the voltage on the input will be represented as a digital value based on the thresholds. Analog – the voltage on the input will be represented as its 10-bit analog value.
On Threshold	Digital (voltages above this value will be a digital high)
Off Threshold	Digital (voltages below this value will be a digital low)
Minimum Voltage	Analog (the minimum operating voltage of the device connected to the input)
Maximum Voltage	Analog (the maximum operating voltage of the device connected to the input)

NOTE: The range for the analog input pins are 0-13.2 volts.

6.1.4 Sending Device Configuration

WARNING

AFTER EVERY PROGRAMMING OF THE RECEIVER, TEST THE UNIT BY UTILIZING THE APPROPRIATE TRANSMITTER. IF THE RECEIVER DOES NOT RESPOND, DO NOT ACTIVATE A FUNCTION BUTTON!

THE RECEIVER MAY HAVE INCORRECT PROGRAMING. RE-CHECK THE PROGRAMMING IN THE RECEIVER AND RETEST. AFTER ACTIVATION OF THE RECEIVER, FUNCTIONALLY TEST ALL COMMANDS ON THE TRANSMITTER BY INITIALLY JOGGING THE BUTTONS, WITH A FULL MOVEMENT, BEFORE RETURNING TO SERVICE. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

To send a program file to a device:

1. Plug in the USB programming cable or position.

NOTE: Reference the specific device manual for details on connecting the USB cable.

2. Click the “Send” button on the RCP screen. A dialog box will pop up confirming that you want to proceed. Check the box marked “I accept,” and then click the button “Continue send to radio.” On-screen prompts will confirm that the receiver has been programmed or if there are any issues.

6.1.5 Receiving Device Configuration

To read a program file from a device:

1. Plug in the USB programming cable or position.

NOTE: Reference the specific device manual for details on connecting the USB cable.

2. Click “Receive” and follow the on-screen prompts.
3. RCP will confirm reception and automatically display current programming in the unit.

NOTE: This will only receive the unit settings. To receive the logic programming information refer to Section 6.2.2.

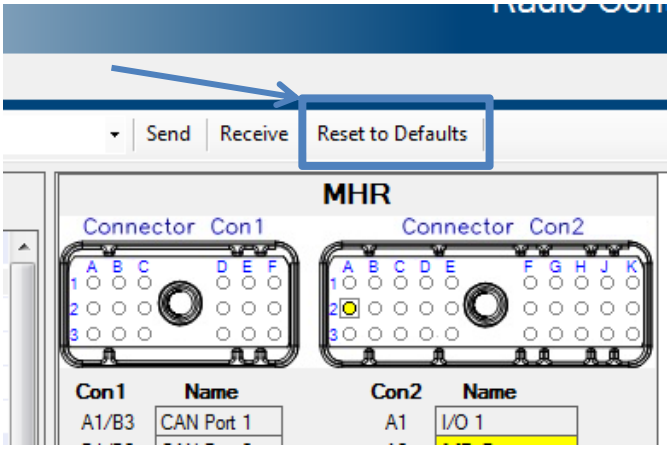
6.1.6 Resetting the Device to Factory Default Settings

Resetting to factory defaults will set the device configuration back to the settings that it was sent from the factory with. This feature is only available for programs that are written by the factory.

1. Plug in the USB programming cable or position.

NOTE: Reference the specific device manual for details on connecting the USB cable.

2. Select the “Reset to Defaults” button.
3. A dialog box will pop up, confirming that you want to proceed. Click the button “OK” to restore the factory default settings. On-screen prompts will confirm that the receiver has been reset to defaults or if there are any issues.
4. Power cycle the device to implement the factory default values.



6.2 Programming Tab

The programming tab page allows the user to map inputs and outputs in the device. The physical inputs can be mapped to physical outputs on the device; alternatively, you can perform a mathematical operation on the input and then direct the result of the mathematical operation to an output channel. For specifics on programming each type of device, please refer to Section 7.

NOTE: The device must be running a specific version of the hex file for it to accept and run the programmed created for it. There are special versions of firmware for the MHR, inteleSmart2 and CAN

receivers. Please contact customer service for details on obtaining the firmware for those receivers. These files are loaded via the FDP tab. See the FDP Tab Page (Section 6.3) for instructions on how to update the firmware.

6.2.1 Programming Tab Layout

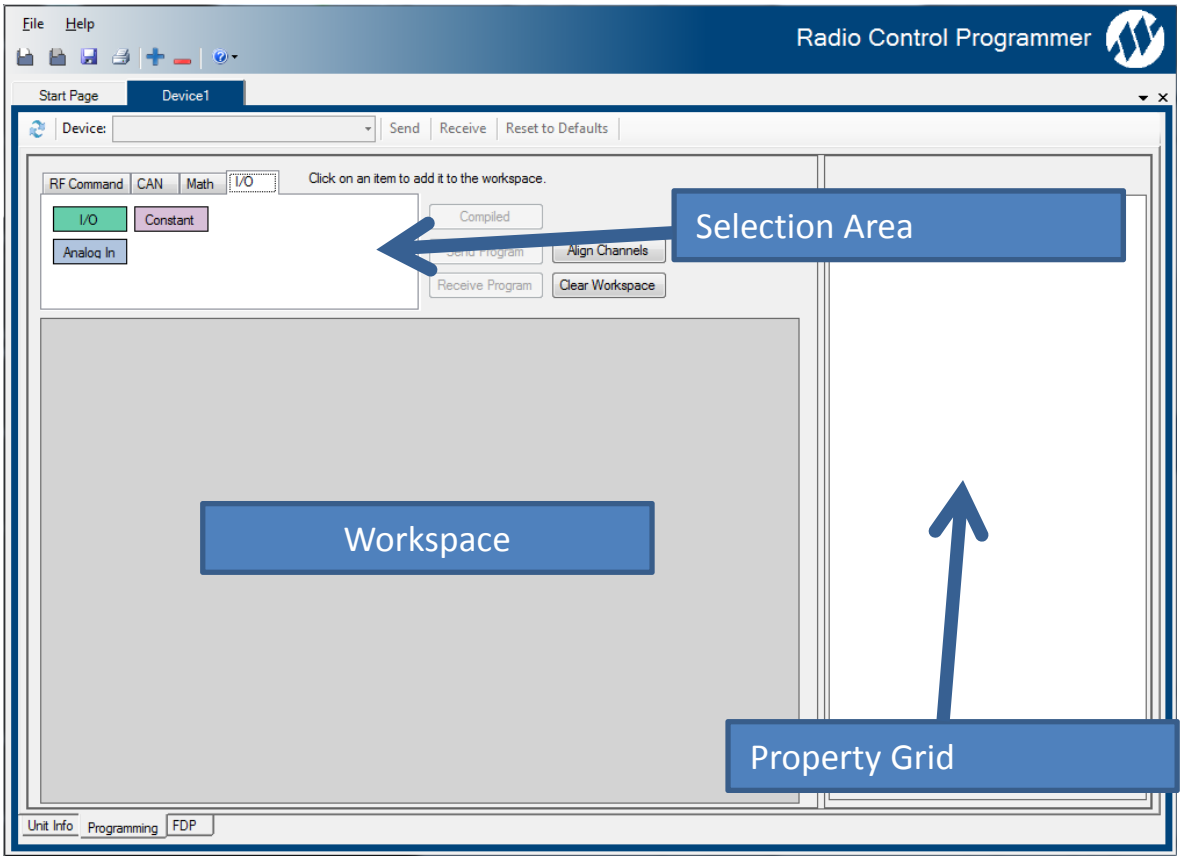


Figure 7: Programming Tab Layout

The programming page is broken into three sections:

- **Selection Area** – This area is where the user adds Commands, Functions, and I/O to the workspace.
- **Workspace Area** – This area is where the user gets a visual representation of the mapping configuration.
- **Property Grid** – This area is populated with a list of properties that are associated with each of the Commands, Functions, and I/O. Each of the properties in the grid can be selected to view a description of that property.

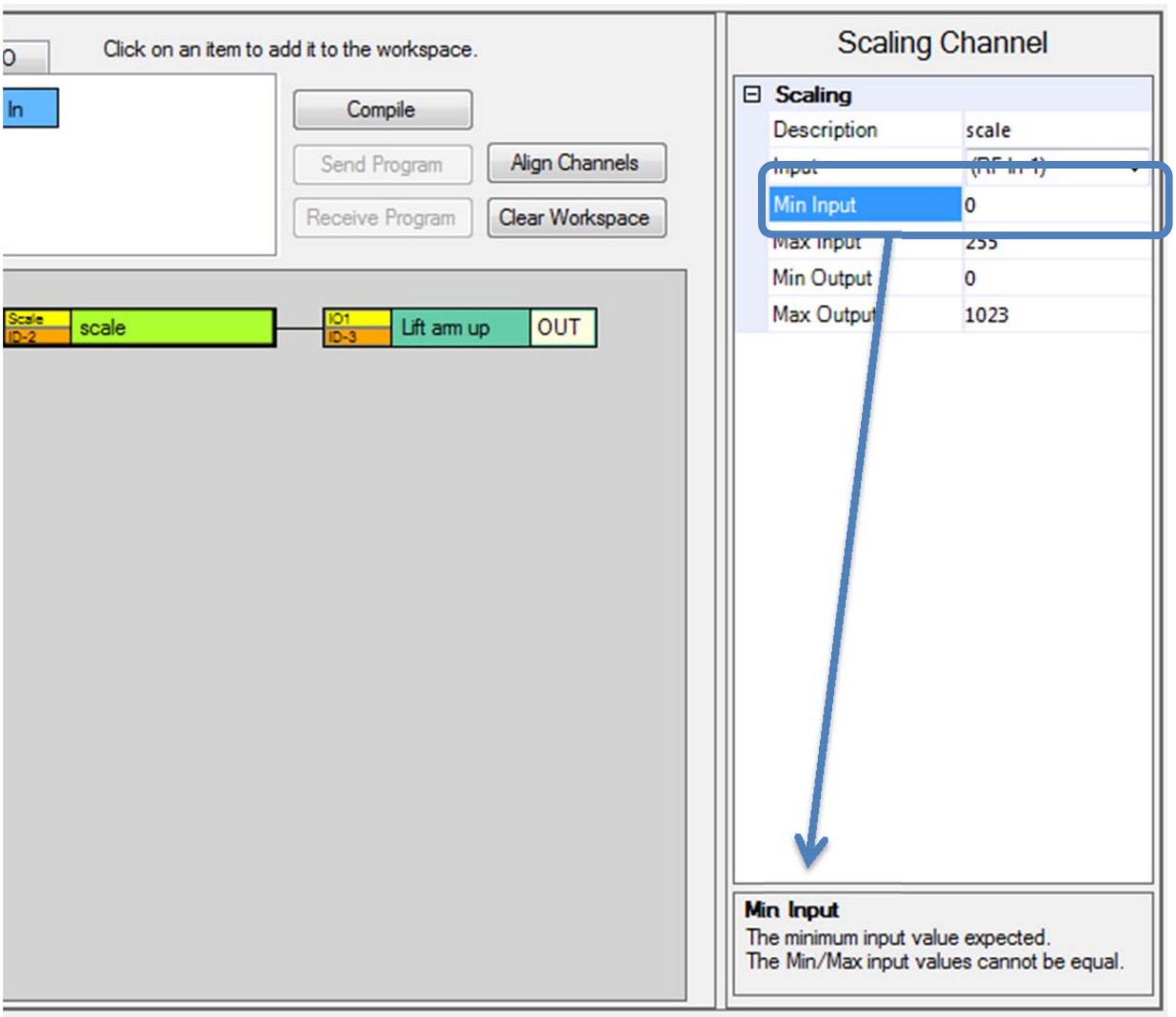


Figure 8: How to Display Help for a Channel Property

Within the property grid there is a section at the bottom that display “help” information about the property. This information is meant to give an overview of what is input expected for that property.

6.2.2 Programming Tab Button Functions

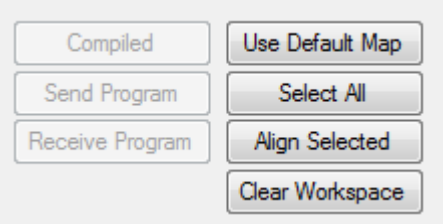


Figure 9: Functions Available on the Programming Tab

Compile Button – This button compiles the channel paths so they can be sent to the device.

Send Button – Sends the configuration to the device. This sends mapping information along with the device and I/O configuration.

Receive Button - Receives the information from the device to populate the workspace and the channels information.

Use Default Map Button – Used only with the in*tele*Smart2 receiver. This button sends the receiver into a default mapping mode that is embedded into the device's firmware file.

Align Selected Button – Aligns the selected channels to the left most channel in the group. This only works if there are multiple channels selected.

Clear Workspace Button – Removes all of the channels from the workspace. Data will be lost as soon as the project is saved.

6.2.3 Channel Selection Tab Groups

NOTE: Not all channel types are available for all devices. Refer to Section 7 for specifics on each device.

The property grid on the right changes based on what type of channel is selected in the workspace area.

When the programming tab page is active, channels can be added to the workspace by clicking on the channels displayed on each of the tabs.

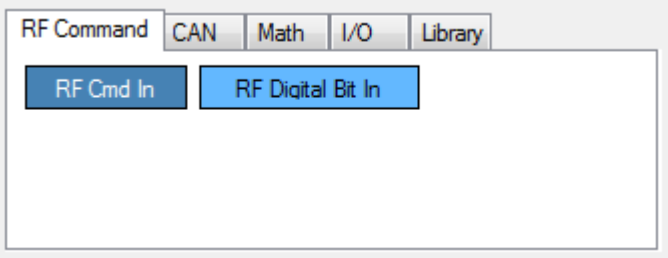


Figure 10: RF Message Channels

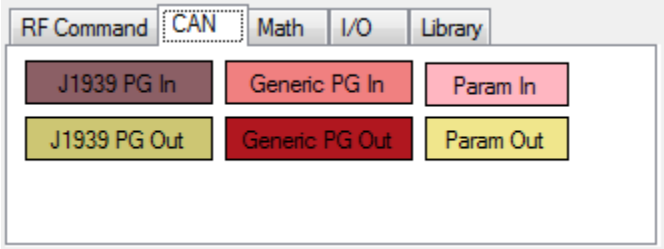


Figure 11: CAN Related Channels

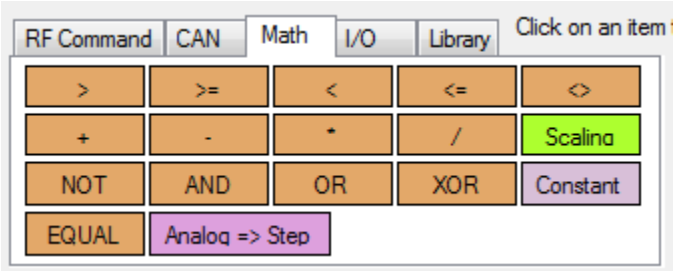


Figure 12: Math Operations Channels

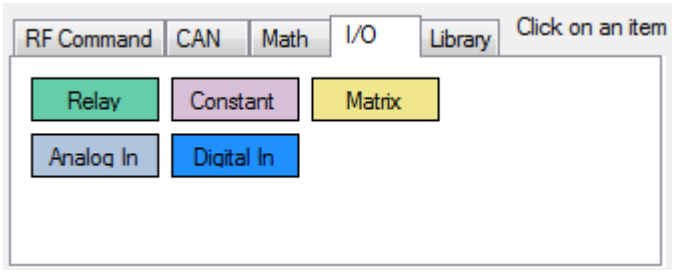


Figure 13: I/O, Constant, and Analog Inputs Channels

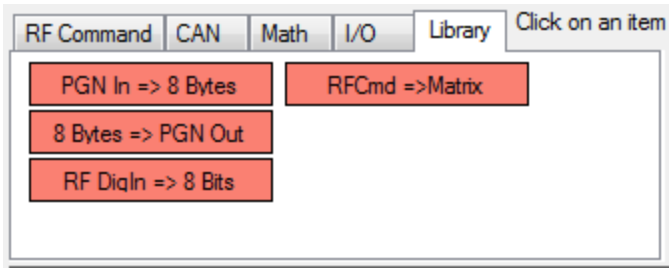


Figure 14: Library Commands

The library commands assist the user by automatically constructing a commonly used set of channels. See the following page for examples of each of the library functions.

When the library group is placed in the workspace, the group is selected so it can be easily dragged to a new location. All library groups are added to the workspace in the same location, so they must be moved or they will overlap with other channels in the workspace.

Figure 15: PGN In -> 8 bytes Command.

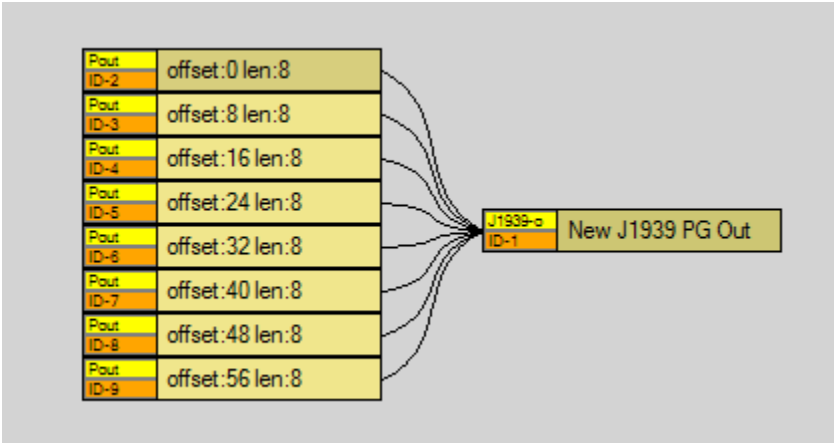


Figure 16: 8 bytes => PGN Out Command.

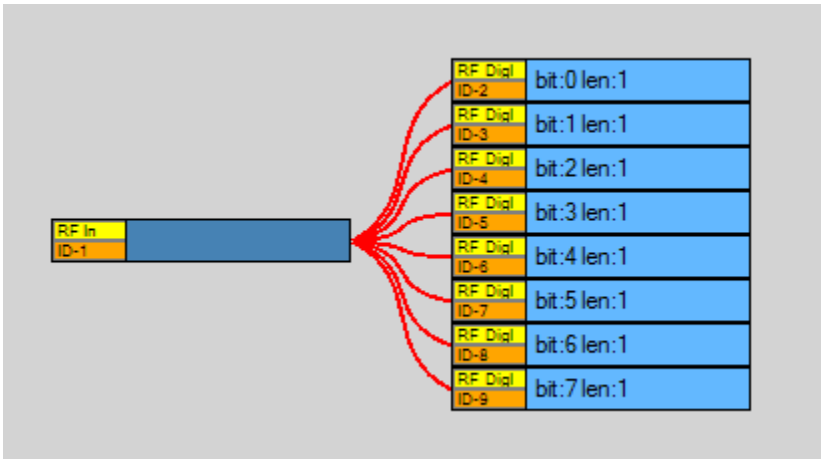


Figure 17: RFCmd Digital In => 8 bits Command

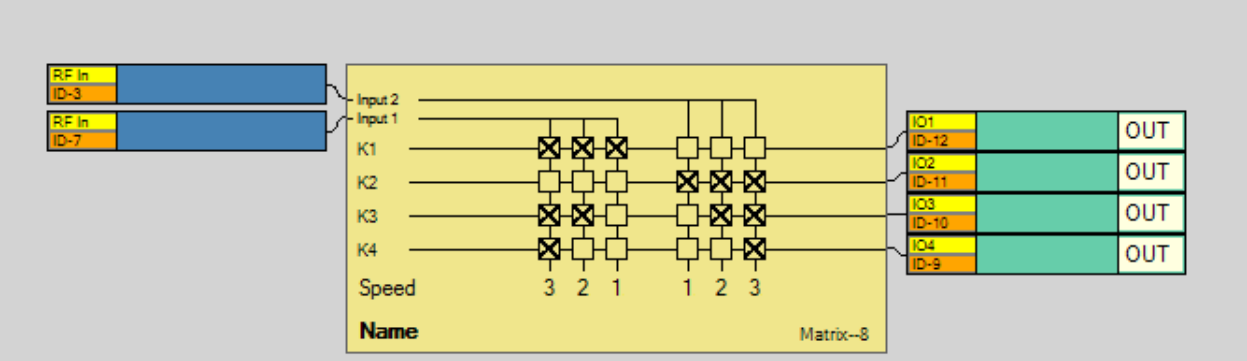


Figure 18: RFCmd => Matrix => Relays

6.3 FDP Tab Page

The Firmware Download Programmer (FDP) is a utility that allows firmware to be loaded on to a device via USB.

WARNING

THERE CAN BE ONLY ONE DEVICE CONNECTED VIA USB WHEN USING FDP.

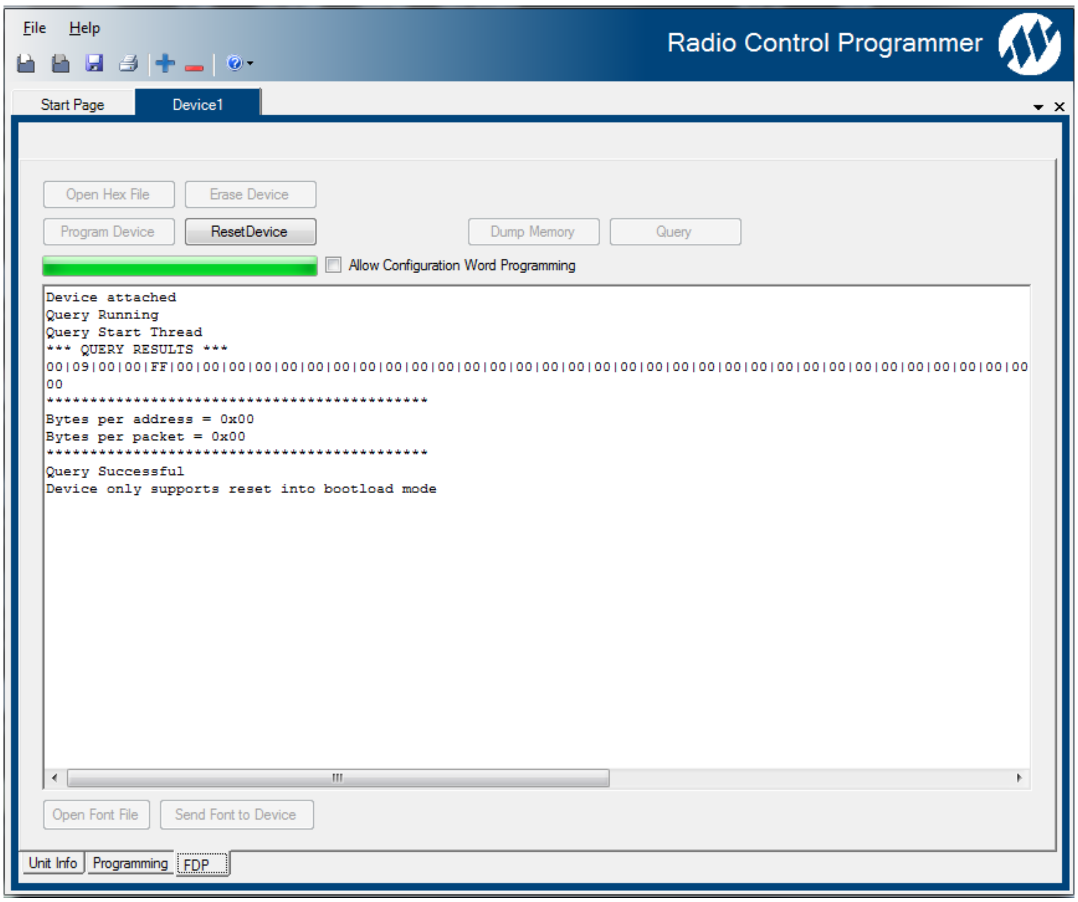


Figure 19: Screen capture of the FDP tab page.

NOTE: If you navigate away from the FDP tab page and the device has been restarted but is not showing in the device list, try clicking the Discover Devices button located in the upper left hand corner of the tab page.

WARNING

THE USER IS RESPONSIBLE FOR LOADING THE CORRECT FIRMWARE ON THE DEVICE. DEVICE BEHAVIOR IS UNKNOWN IF THE WRONG FIRMWARE IS LOADED ON THE DEVICE. LOADING FIRMWARE FOR ANOTHER TYPE OF DEVICE CAN CAUSE THE DEVICE TO BE INOPERABLE.

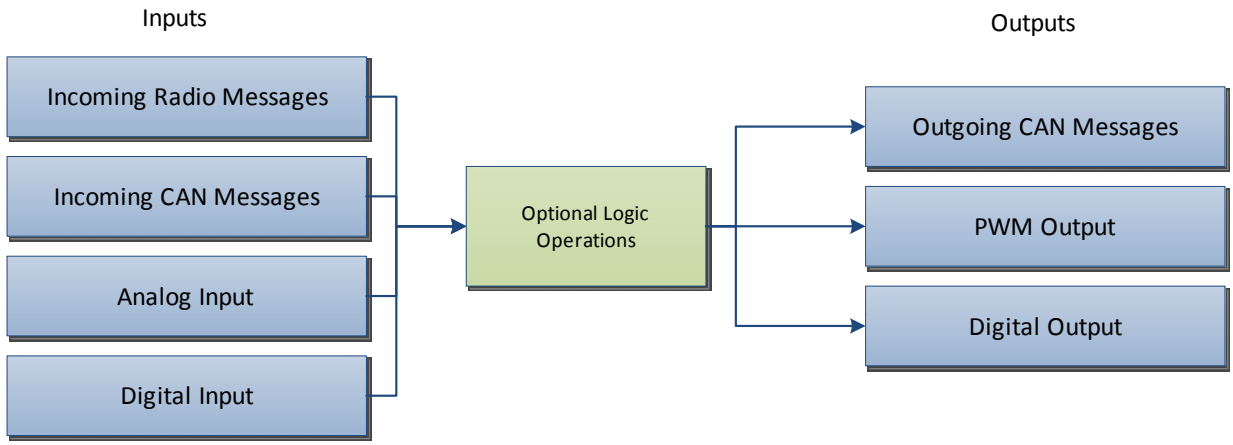
6.3.1 Steps to Load Firmware

1. Click the “ResetDevice” button to place the device in to bootloader mode.
    a. Placing the device in bootloader mode allows firmware to be loaded on the device.
    b. Once the device is reset the other buttons will be enabled.
    c. The text area will be updated with the status of the reset.
2. Click “Open Hex File” (this will open an Open File Dialog window).
    a. Navigate to the appropriate folder and select the firmware file to load on the device.
    b. The text area will show that the file has been loaded.
3. Click “Program Device”.
    a. The text area will display the status of the firmware load and display a message stating that the firmware has completed.
4. Once the firmware has been programmed, the device can be reset by clicking on “Reset Device” to run the newly loaded firmware.

7 Device Programming

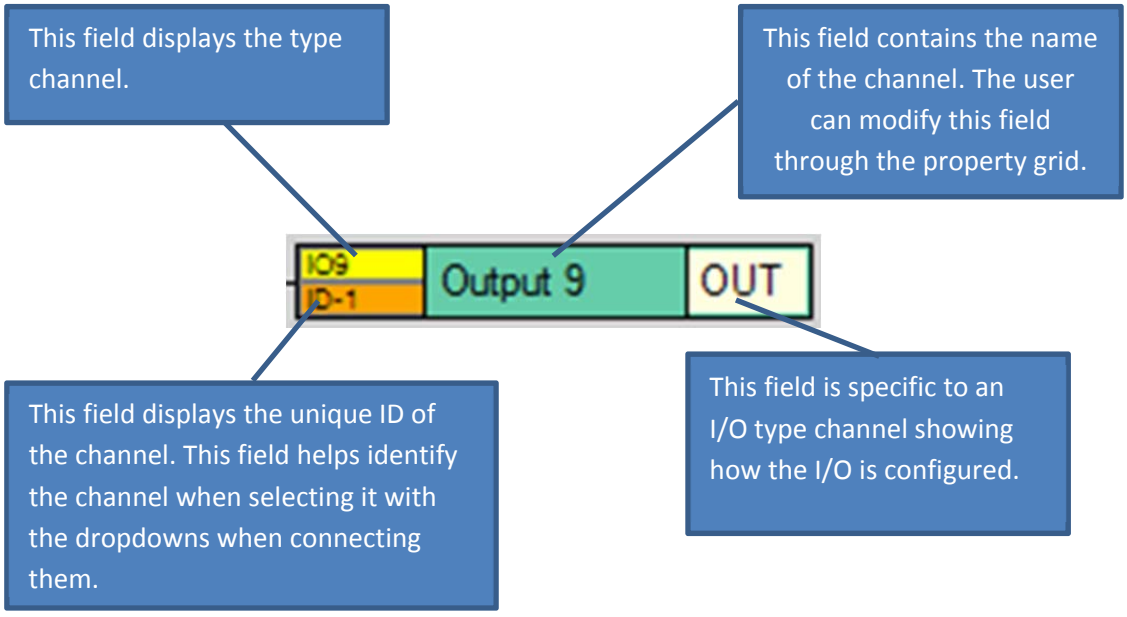
7.1 How to Create Mapping

Mapping is connecting inputs to outputs.



Depending on the device the number and type of Inputs and Outputs will vary.

7.1.1 Channel Image Field Description



7.1.2 Connection Limits

Mathematical objects (Arithmetic/Relational/Logical) are limited to five consecutive objects connecting to each other (see Figure 20: Math Operator Limits for example).

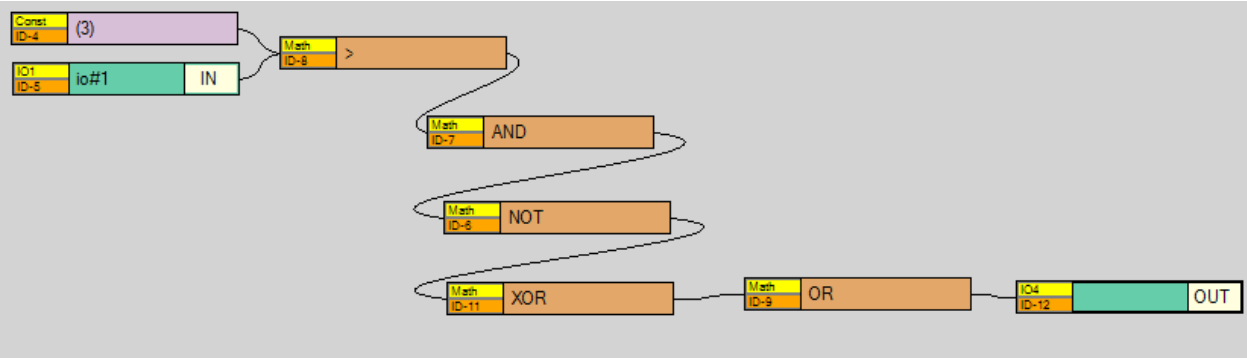


Figure 20: Math Operator Limits

Other connection limits are based on the type of input they can accept and what value the object produces as output. The object's input type is predefined and can only connect to objects that have an output of that type. All the objects that have that output type are listed in the dropdown boxes for that object.

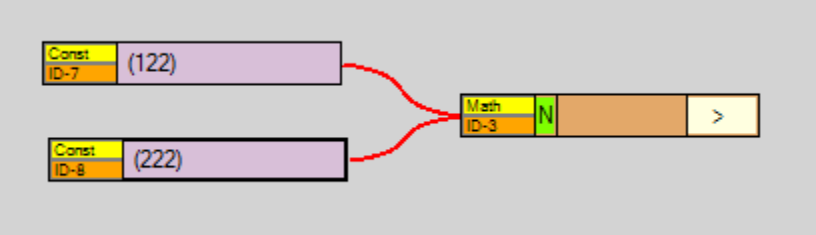


Figure 21: Workspace view of math operation.

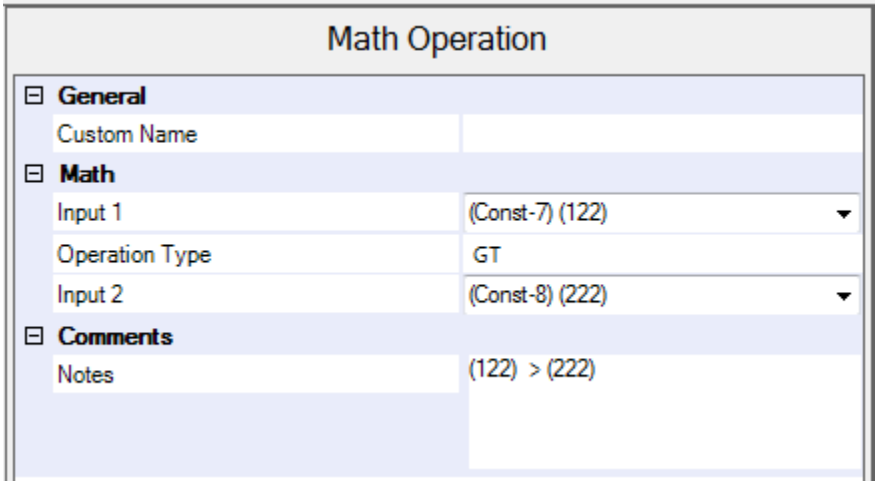


Figure 22: The equation is shown in the Notes field.

7.1.3 Channel Limits

Table 7 lists the maximum number of channels that can be programmed via RCP per device.

Table 7: Channel Limits

Device	Maximum Number of Channels
MHR/MHC	192 (Firmware prior to version 3.1.0 can only support 64 channels)
CAN-2	192
in*tele*Smart2	192

7.1.4 Channel Connection Description

The connections in the workspace describe how data will flow and how it is manipulated prior to being used in an output channel.

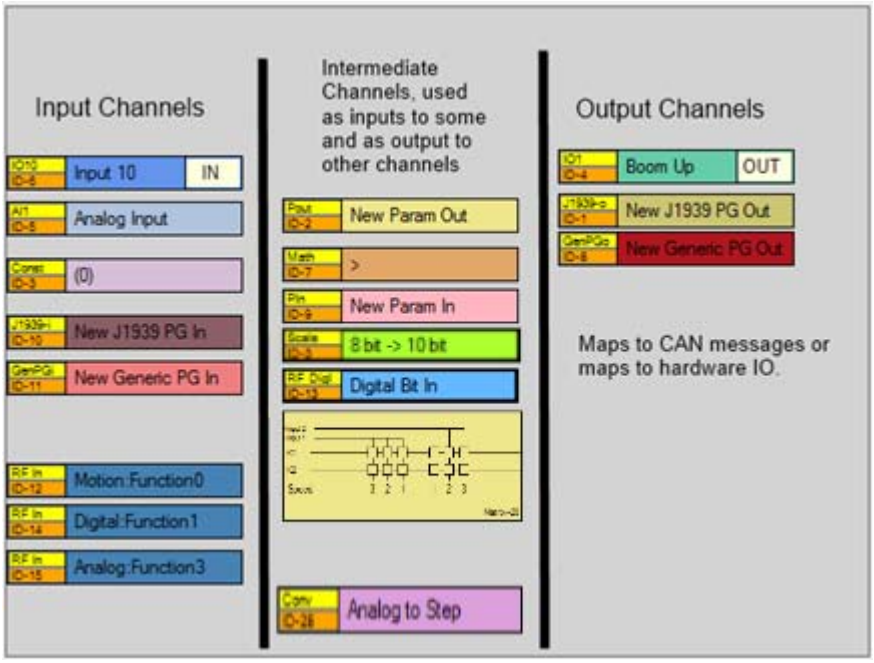


Figure 23: Types of Channels

The following describes all of the available channel types. For each type there is a description of what the channel is, the channel size (the bit size of the channel), what types of channel inputs can be mapped to the channel, and the devices this channel type is supported on.

7.1.4.1 Analog Input Channel

Description: The analog input channel is used to measure an analog value and convert it into a digital value that can be used as input to other channels. Refer to the product manual for each device to determine what types of analog inputs are supported.
Value Size: 10 bits
Supported Input Connection Types: Mapped to physical hardware
Supported Devices: MHR, MHC, in*tele*Smart2

7.1.4.2 Digital Input Channel

Description: The digital input channel is used to determine if there is a voltage on an input pin. If there is a voltage present, the digital input will be high; otherwise the input will be low. The value can then be used as input to other channels.
Value Size: 1 bit
Supported Input Connection Types: Mapped to physical hardware
Supported Devices: MHR, MHC, in*tele*Smart2

7.1.4.3 Digital Output Channel

Description: The digital output channel is used to set the voltage level on the output connection configured by the channel properties.
Value Size: 10 bits (MHR/MHC) (any value greater than 0 will be represented as digital high)
1 bit (in*tele*Smart2 and CAN-2)
Supported Input Connection Types: IO (input), Math, Pin (CAN parameter in), RF Command (in), RF Digital Bits (in), Constant, Scaling
Supported Devices: MHR, MHC, in*tele*Smart2, CAN-2

7.1.4.4 PWM Output Channel

Description: These channels will output a PWM signal that is either open loop PWM or current compensated PWM (closed loop). The PWM frequency is set in the Unit Info screen. Refer to Section 6.1 for additional information on how to set this. To set this output type, select the I/O channel type and choose one of the PWM output types.
Value Size: 10 bits
Supported Input Connection Types: IO (input), Math, Pin (CAN parameter in), RF Command (in), RF Digital Bits (in), Constant, Scaling
Supported Devices: MHR, MHC

7.1.4.5 Analog To Step Channel

Description: Converts an 8 bit analog value (0-255) into a discrete step value used as input to a matrix channel. This is typically used to convert analog RF Command values from a proportional transmitter into values that make it look like a transmitter sending discrete step values.
Value Size: 8 bit
Supported Input Connection Types: Math, Constant, RFIn, RF Dig In
Supported Devices: in*tele*Smart2

7.1.4.6 Matrix Channel

Description: Makes configuring relays simpler by grouping them and allowing them to be driven via input without the need for additional math channels.
Value Size: - Input: (1-12) 1-bit values
- Input: (2) 8-bit values
- Output: (1-12) 1-bit outputs
Supported Input Connection Types: IO (input), Math, Pin (CAN parameter in), RF Command (in), RF Digital Bits (in), Constant, Scaling, Analog To Step
Supported Devices: in*tele*Smart2

7.1.4.7 Math Operator Channel

Description: Performs math operation on an input or number of inputs. The available math operator channels are: Greater Than, Greater Than Or Equal To, Less Than, Less Than Or Equal To, Not Equal, Equals, Addition, Subtraction, Multiplication, Division, NOT, AND, OR, XOR. All of the relational operators output a 1 bit value while all other operators will output a 16 bit value.
Value Size: 16 bits
Supported Input Connection Types: IO (input), Math, CAN (Parameter in), RF Command (in), RF Digital Bits (in), Constant, Scaling
Supported Devices: MHR, MHC, in*tele*Smart2, CAN-2

7.1.4.8 CAN Parameter Group (Input) Channel

Description: There are two types of PG Input channels, J1939 PG In and Generic PG In. One is used for J1939 CAN messages and the other can be used for all other CAN message protocols. This channel type then needs to connect to parameter input channels (Param In), which will provide access to the data within the CAN message.
Value Size: 64 bits (8 bytes of CAN Data)
Supported Input Connection Types: Message directly coming in from the CAN bus
Supported Devices: MHR, MHC, in*tele*Smart2, CAN-2

7.1.4.9 CAN Parameter Group (Output) Channel

Description: There are two types of PG Output channels, J1939 PG Out and Generic PG Out. One is used for J1939 CAN messages and the other can be used for all other CAN message protocols. This channel type configures the header information for the CAN message before transmission.
Value Size: 64 bits (8 bytes of CAN Data)
Supported Input Connection Types: Param Out
Supported Devices: MHR, MHC, in*tele*Smart2, CAN-2

7.1.4.10 CAN Parameter (Input) Channel

Description: Used to parse data from an incoming CAN message.
Value Size: 1-8 bits (selectable through property)
Supported Input Connection Types: J1939 PG In, Generic PG In
Supported Devices: MHR, MHC, in*tele*Smart2, CAN-2

7.1.4.11 CAN Parameter (Output) Channel

Description: Used to capture/format data for an outgoing CAN message.
Value Size: 1-8 bits (configured through property)
Supported Input Connection Types: IO (Input), Math, CAN (Parameter In), Constant, RF Command, RF Command Digital Byte Bits (In), Scaling
Supported Devices: MHR, MHC, in*tele*Smart2, CAN-2

7.1.4.12 RF Command Input Channel

Description: Used to access the data from incoming RF messages.
Value Size: 8 bits
Supported Input Connection Types: Incoming Radio Messages
Supported Devices: MHR, in*tele*Smart2, CAN-2

7.1.4.13 RF Digital Bits Input Channel

Description: Used to parse individual bits from an incoming RF command that is configured as a digital command.
Value Size: 1-8 bits (configured through property)
Supported Input Connection Types: Incoming Radio message channels configured as digital
Supported Devices: MHR, in*tele*Smart2, CAN-2

7.1.4.14 Scaling Channel

Description: Used to redefine the input values of the channel. For example, this channel can be used to convert an 8-bit value to a 10-bit value.
Value Size: Varies depending upon the configuration (16 bit max)
Supported Input Connection Types: IO (Input), Math, CAN (Parameter In), Constant, RF Command, RF Command Digital Byte Bits (In), Scaling
Supported Devices: MHR, MHC, in*tele*Smart2, CAN-2

7.1.4.15 Constant Channel

Description: Used to define a literal value or a percentage. When defined as a percentage it can only be used for as input to relational type math channels. i.e. ==, != >, <, >=, <=
All operations are performed using integer math resulting in a loss of precision.
Value Size: Varies depending upon the configuration (16 bit max)
Supported Input Connection Types: There are no inputs to this channel type
Supported Devices: MHR, MHC, in*tele*Smart2, CAN-2

7.2 Transmitter Component to RF Message Mapping

The location in which switches are plugged into an I/O board of a transmitter determines how the data from the switch is sent to the receiver. The decoding of this data is mapped differently depending on the type of I/O board being utilized. Section 7.2.1 shows the physical connections of each of the I/O boards that have the ability for a user to change how components are plugged in. Section 7.2.2 shows the mapping of the I/O board connections to the RF commands. Information from both of these sections is required to properly determine how a connection into an I/O board will be decoded on the receiver.

7.2.1 Transmitter I/O Connections

Table 8: I/O Board Part Numbers shows the part numbers required for each of the I/O boards to properly support the RF command mapping. Other part numbers for different I/O boards exist, but may not properly support the standard RF command mapping. There may also be some software changes required to properly support the mapping. If the connections are not mapping as expected, contact customer support to ensure the required software is loaded on the device.

Table 8: I/O Board Part Numbers

Device	Part Numbers
XLTX I/O	25-08-052-205E
MLTX2 I/O	25-10-122-202E
MBT/PGT Toggle	25-09-052-208E
MBT/PGT Generic	25-09-052-202E Rev. 2

For example (using Figure 24), if a toggle is connected into T12, look up the MLTX2 transmitter in the Mapping table and see what Command Function is mapped to contain the T12 data. In this example, the toggle data for T12 is received in Command Function Digital Byte 2, in bit 6 for toggle position A and bit 7 for toggle position B.

NOTE: Similar connections are laid out the same for each of the connection types.

Table 9: Pin out Legend

Connection	Definition
VCC	Source Voltage
P_COM	Ground
Direction#A/B	Digital Connection that determines the direction of the paddle.
Motion#	Analog Input
Analog#	Analog Input
Rotary#	Digital Input connection for each of the rotary positions
Toggle#	Digital input for a toggle connection

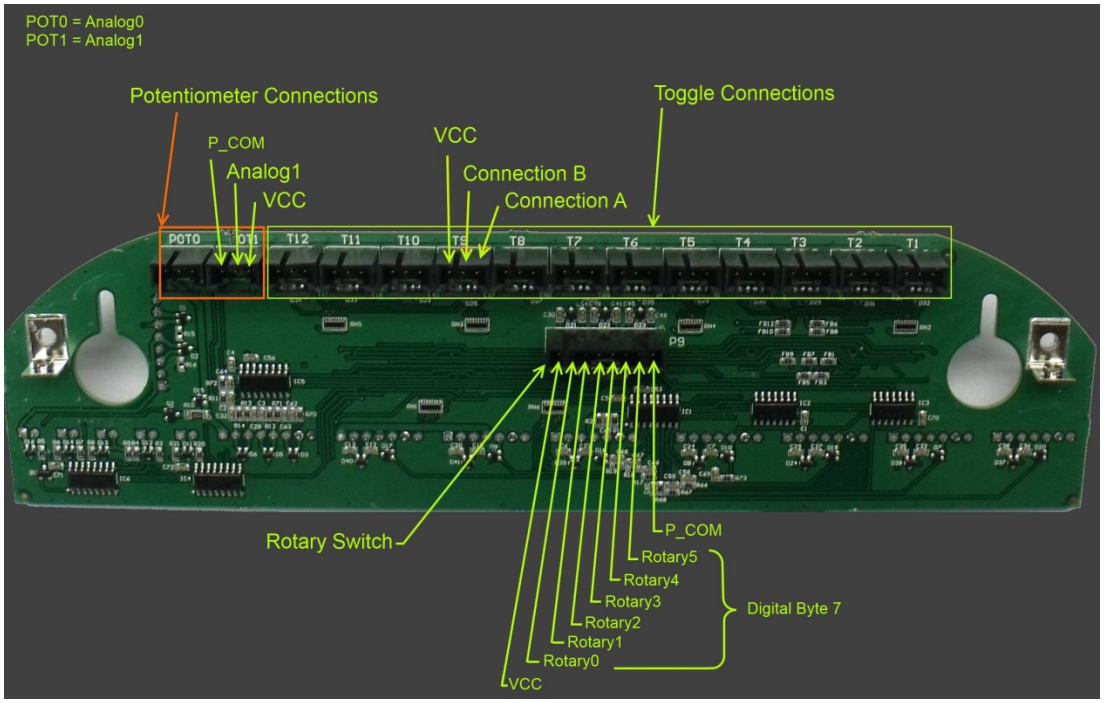


Figure 24: MLTX2 Labeled Toggle Connections (Side 1)

To map a paddle's forward and reverse motion when the paddle is plugged into the Motion1 connection, two channels are required in RCP to handle the forward and the reverse motions. To determine how the channels are configured, refer to Table 10, Table 11, and Table 12 to determine the Command Function values. From the table, you see that the forward motion maps to Command Function 1 and the reverse motion maps to Command Function 2.

For the Analog connection there are various components that can connect to this connection. The analog pins on the connector map to Analog Functions 9-13 when configuring the RF channel in RCP.

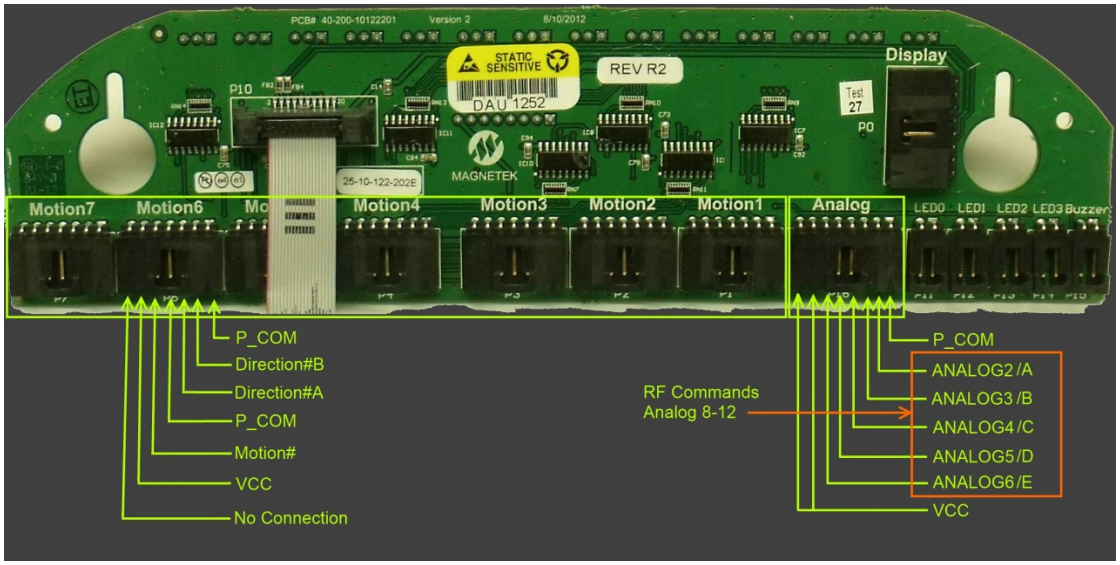


Figure 25: MLTX2 Motion and Analog Connections (Side 2)

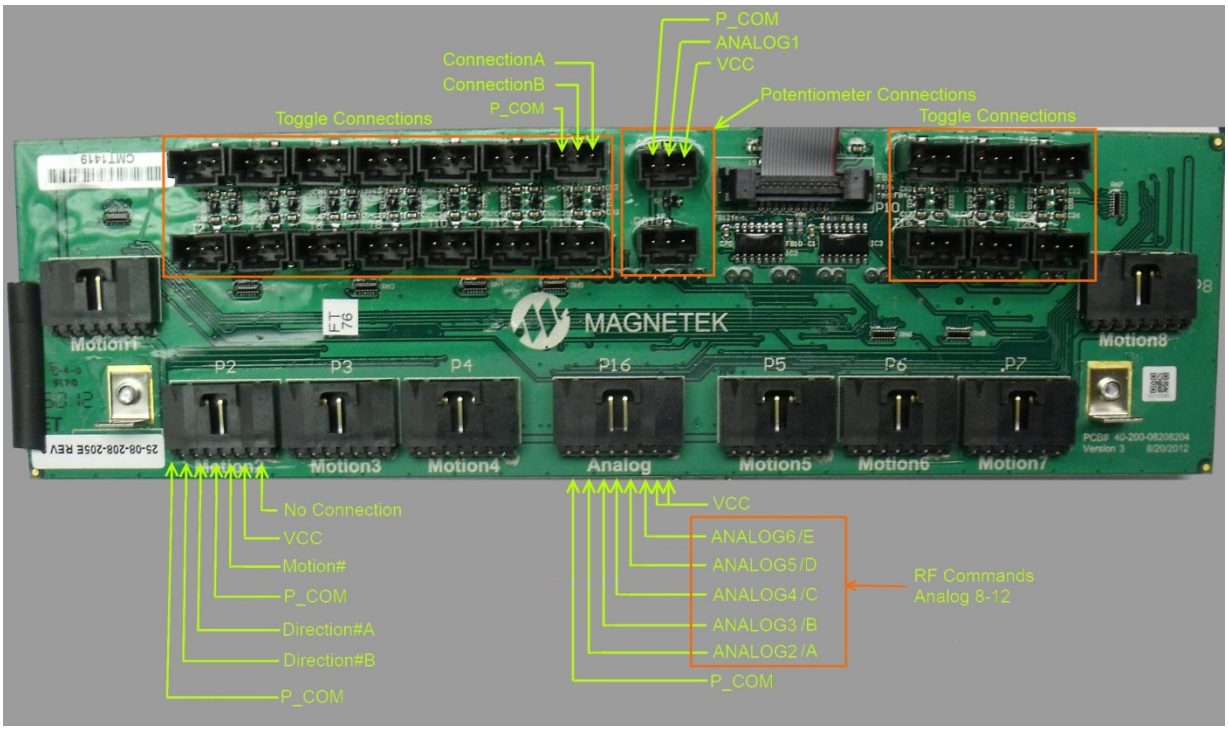


Figure 26: XLTX Connections (Side 1)

When connecting a dial to the POT0 connection on an XLTX, the RF Command channel in RCP would be configured as Analog and the Function property would be Function 1.

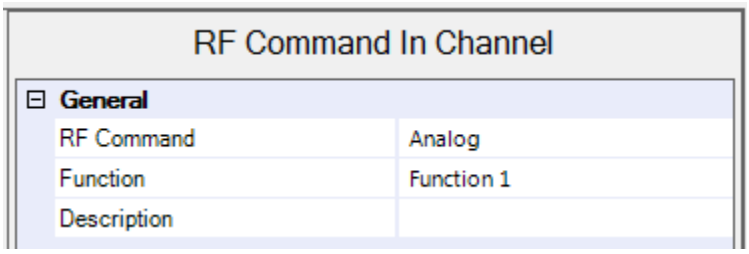


Figure 27: Dial connected to POT0 as seen through RCP property configuration

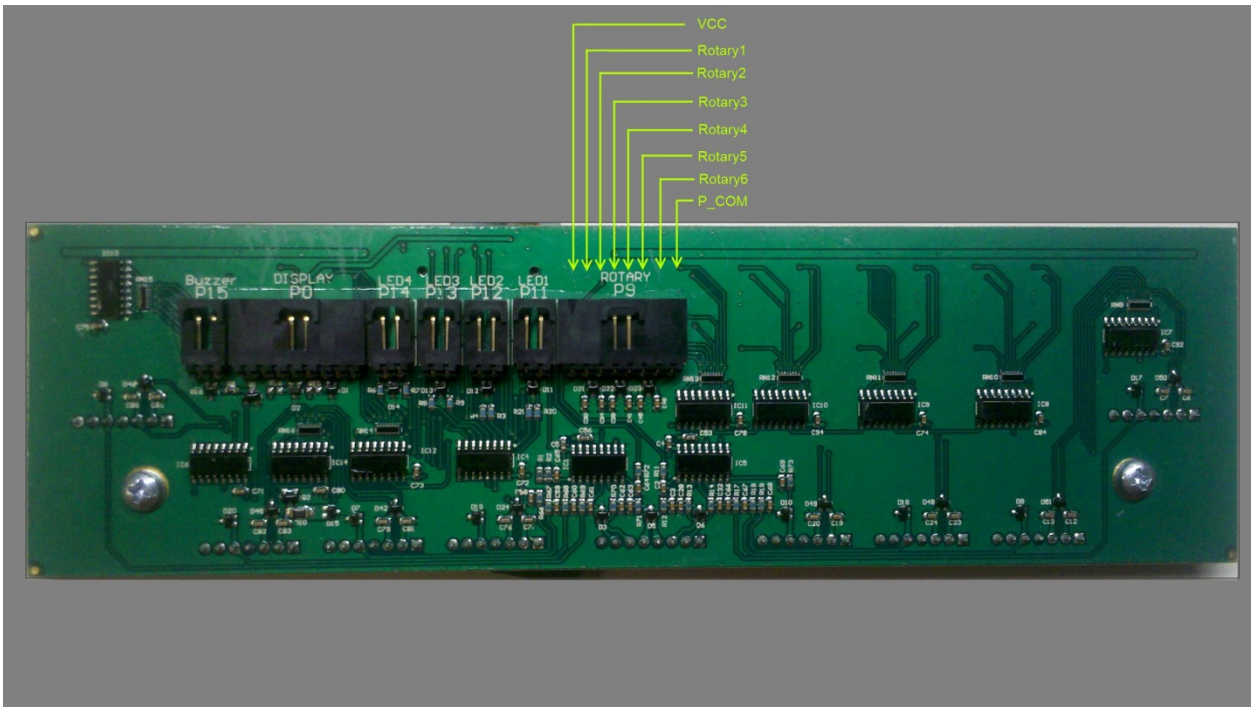


Figure 28: XLTX (Side 2)

Side 2 contains the connections for the Rotary switch, Buzzer, Display board and LEDs 1-4.

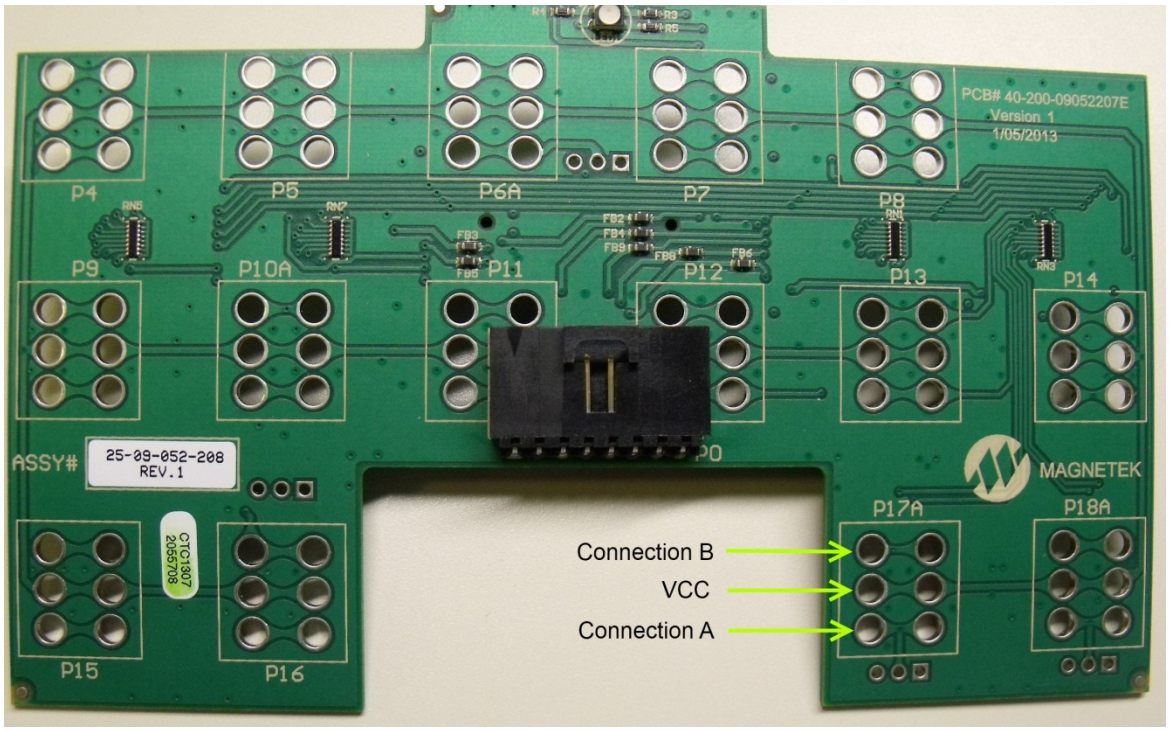


Figure 29: MBT/PGT Toggle Board (Side 1)

NOTE: Similar connections are laid out the same for each of the connection types. The orientation is the same for each of the 6 hole connector pads.

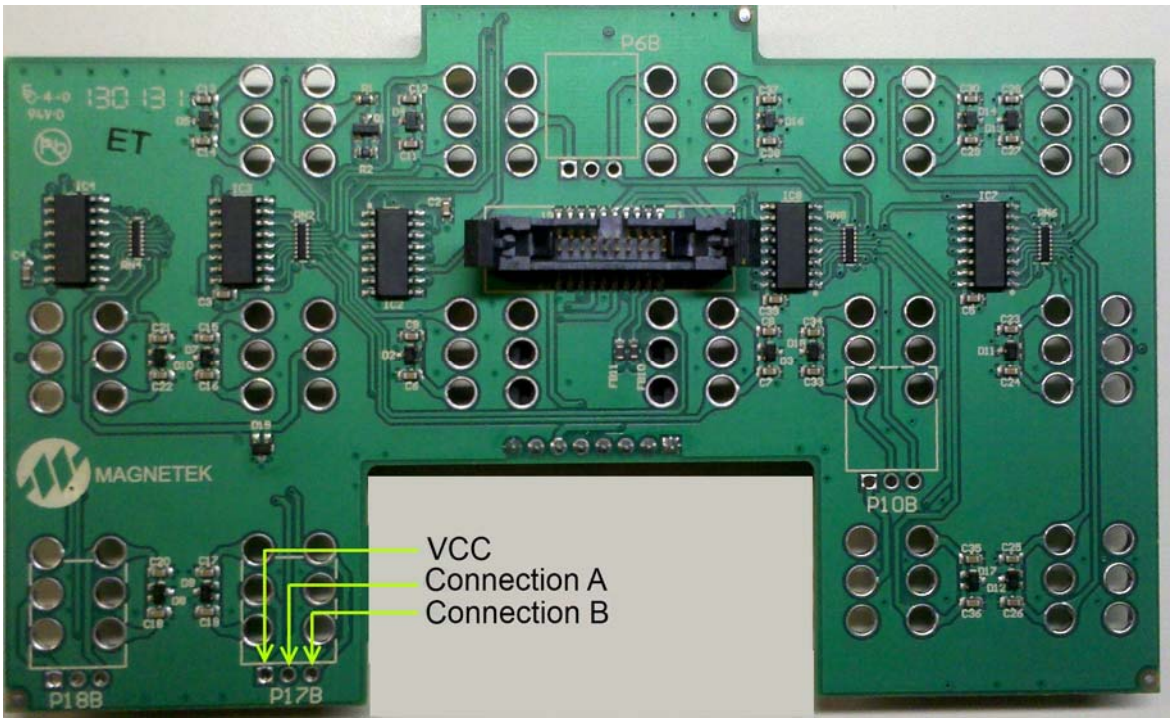


Figure 30: MBT/PGT Toggle Board (Side 2)

NOTE: Similar connections are laid out the same for each of the connection types. The orientation is the same for each of the 3 hole connector pads.

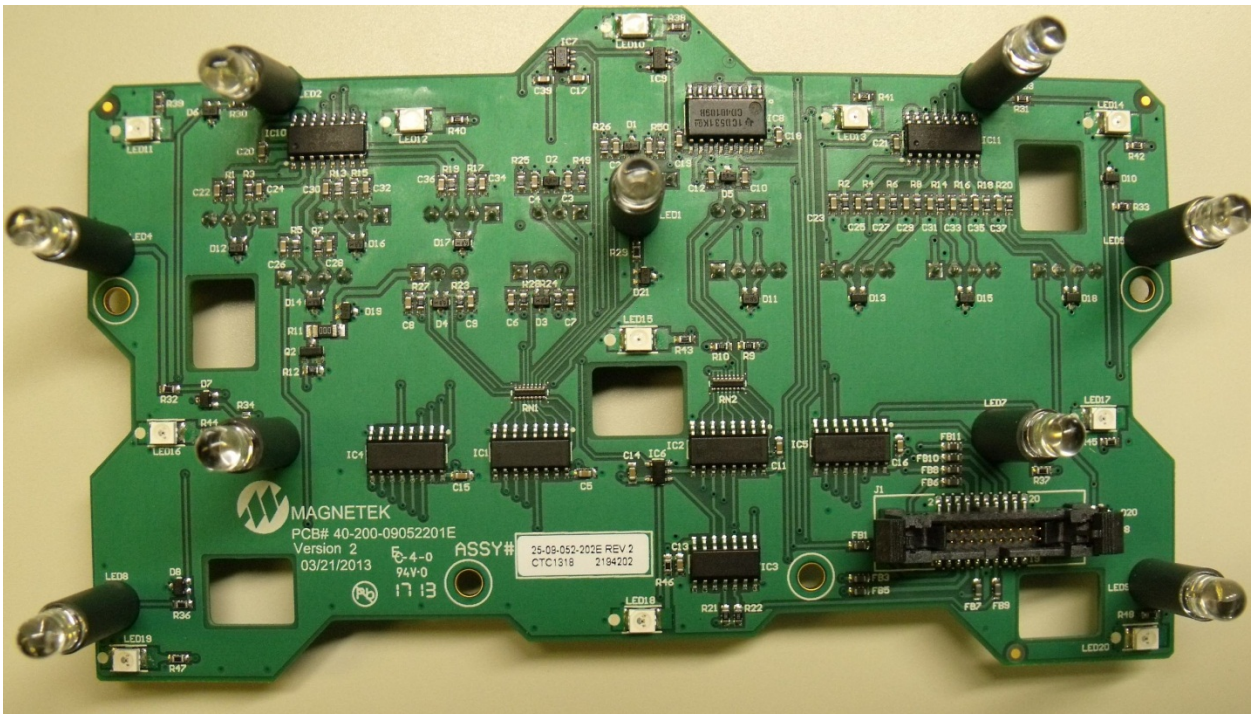


Figure 31: MBT/PGT Generic IO Board (Side 1)

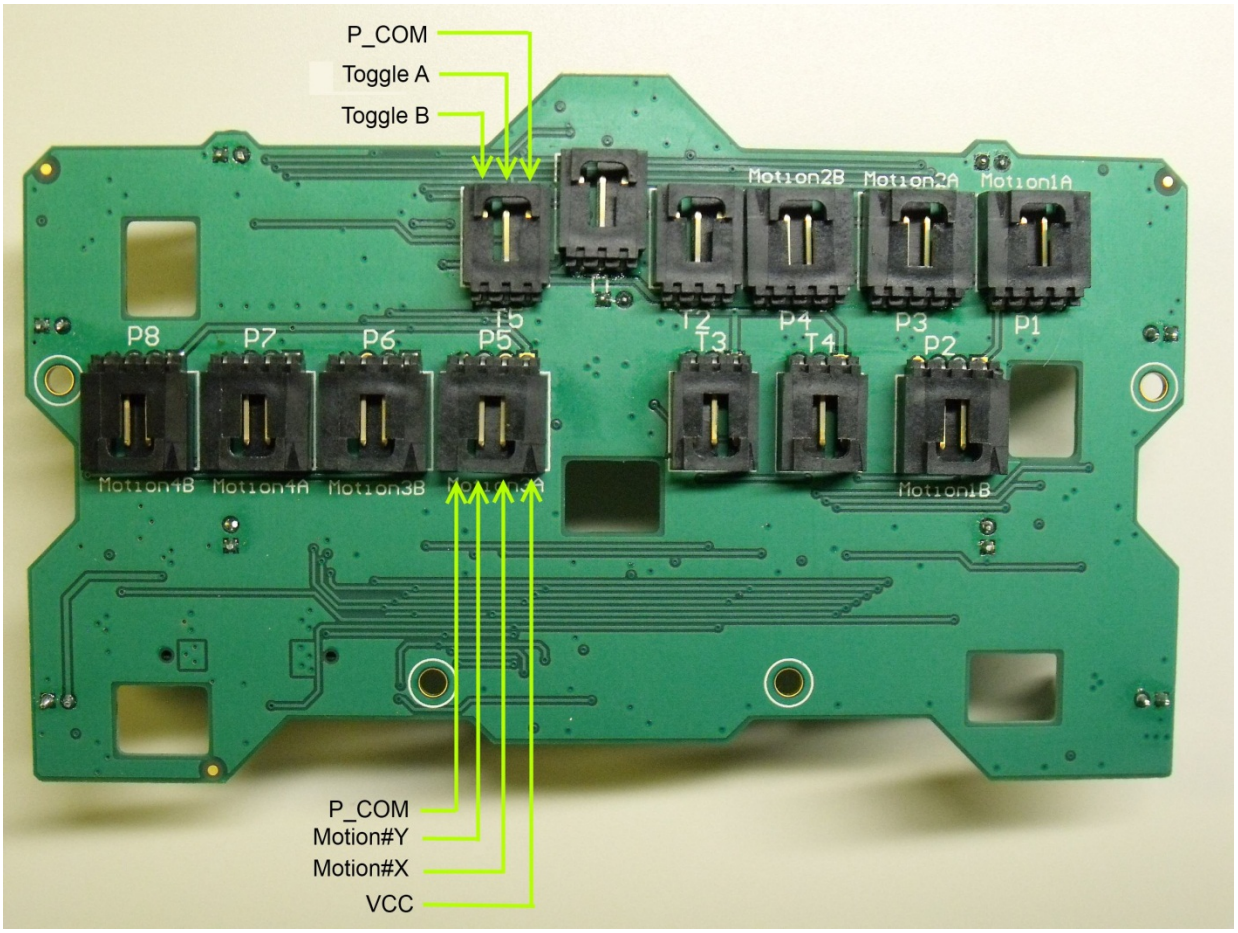


Figure 32: MBT/PGT Generic I/O Board (Side 2)

7.2.2 Transmitter Radio Message Mapping

This table shows the typical Command Function mappings for each of the transmitters. The Command Functions represent connections on the I/O board inside the transmitter.

The Command Function column directly corresponds to connectors on the transmitter I/O boards. See Transmitter I/O Connections (Section 7.2.1) to see the physical connector on the various I/O boards.

Table 10: Motion Commands

RF Command In		Transmitter PCB Connections						
Function	**RF Command**	**XLTX I/O**	**MLTX2 I/O**	**Flex Pro**	**Flex VUE**	**Flex EM**	**Flex EX**	**MBT/PGT I/O**
Function1	Motion	Motion1- Dir#A	Motion1- Dir#A	Button1	Button1	Button1	Button1	Motion1- Dir#A
Function2	Motion	Motion1- Dir#B	Motion1- Dir#B	Button2	Button2	Button2	Button2	Motion1- Dir#B
Function3	Motion	Motion2- Dir#A	Motion2- Dir#A	Button3	Button3	Button3	Button3	Motion2- Dir#A
Function4	Motion	Motion2- Dir#B	Motion2- Dir#B	Button4	Button4	Button4	Button4	Motion2- Dir#B
Function5	Motion	Motion3- Dir#A	Motion3- Dir#A	Button5	Button5	Button5	Button5	Motion3- Dir#A
Function6	Motion	Motion3- Dir#B	Motion3- Dir#B	Button6	Button6	Button6	Button6	Motion3- Dir#B
Function7	Motion	Motion4- Dir#A	Motion4- Dir#A	Button7	Button7	Button7	Button7	Motion4- Dir#A
Function8	Motion	Motion4- Dir#B	Motion4- Dir#B	Button8	Button8	Button8	Button8	Motion4- Dir#B
Function9	Motion	Motion5- Dir#A	Motion5- Dir#A	Button9	Button9	Button9	Button9	Motion5- Dir#A
Function10	Motion	Motion5- Dir#B	Motion5- Dir#B	Button10	Button10	Button10	Button10	Motion5- Dir#B
Function11	Motion	Motion6- Dir#A	Motion6- Dir#A	Button11	Button11	Button11	Button11	Motion6- Dir#A
Function12	Motion	Motion6- Dir#B	Motion6- Dir#B	Button12	Button12	Button12	Button12	Motion6- Dir#B
Function13	Motion	Motion7- Dir#A	Motion7- Dir#A					Motion7- Dir#A
Function14	Motion	Motion7- Dir#B	Motion7- Dir#B					Motion7- Dir#B
Function15	Motion	Motion8- Dir#A						Motion8- Dir#A
Function16	Motion	Motion8- Dir#B						Motion8- Dir#B

Table 11: Digital Commands

RF Command In		RF Digital Bit In		Transmitter PCB Connection			
Function	**RF Command**	**Starting Bit**	**Length**	**XLTX I/O**	**MLTX2 I/O**	**MBT/PGT Toggle**	**MBT/PGT Generic**
Function 1	Digital	0	1	A-T1	A-T1		A-T1
		1	1	B -T1	B -T1		B -T1
		2	1	A-T2	A-T2		A-T2
		3	1	B -T2	B -T2		B -T2
		4	1	A-T3	A-T3		A-T3
		5	1	B -T3	B -T3		B -T3
		6	1	A-T4	A-T4	A-T4	A-T4
		7	1	B -T4	B -T4	B -T4	B -T4
Function 2	Digital	0	1	A-T5	A-T5	A-T5	A-T5
		1	1	B -T5	B -T5	B -T5	B -T5
		2	1	A-T6	A-T6	A-T6A	
		3	1	B -T6	B -T6	B -T6A	
		4	1	A-T7	A-T7	A-T7	
		5	1	B -T7	B -T7	B -T7	
		6	1	A-T8	A-T8	A-T8	
		7	1	B -T8	B -T8	B -T8	
Function 3	Digital	0	1	A-T9	A-T9	A-T9	
		1	1	B -T9	B -T9	B -T9	
		2	1	A-T10	A-T10	A-T10A	
		3	1	B -T10	B -T10	B -T10A	
		4	1	A-T11	A-T11	A-T11	
		5	1	B -T11	B -T11	B -T11	
		6	1	A-T12	A-T12	A-T12	
		7	1	B -T12	B -T12	B -T12	
Function 4	Digital	0	1	A-T13		A-T13	
		1	1	B -T13		B -T13	
		2	1	A-T14		A-T14	
		3	1	B -T14		B -T14	
		4	1	A-T15		A-T15	
		5	1	B -T15		B -T15	
		6	1	A-T16		A-T16	
		7	1	B -T16		B -T16	
Function 5	Digital	0	1	A-T17		A-T17A	
		1	1	B -T17		B -T17A	
		2	1	A-T18		A-T18A	
		3	1	B -T18		B -T18A	
		4	1	A-T19			
		5	1	B -T19			
		6	1	A-T20			
		7	1	B -T20			

RF Command In		RF Digital Bit In		Transmitter PCB Connection			
Function	RF Command	Starting Bit	Length	XLTX I/O	MLTX2 I/O	MBT/PGT Toggle	MBT/PGT Generic
Function 6	Digital	0	1				
		1	1				
		2	1				
		3	1				
		4	1				
		5	1				
		6	1				
		7	1				
Function 7	Digital	0	1				
		1	1				
		2	1				
		3	1				
		4	1				
		5	1				
		6	1				
		7	1				
Function 8	Digital	0	1	RotaryA	RotaryA		
		1	1	RotaryB	RotaryB		
		2	1	RotaryC	RotaryC		
		3	1	RotaryD	RotaryD		
		4	1	RotaryE	RotaryE		
		5	1	RotaryF	RotaryF		
		6	1				
		7	1				
Function 9	Digital	8bits					
Function 10	Digital	8bits					
Function 11	Digital	8bits					
Function 12	Digital	8bits					
Function 13	Digital	8bits					
Function 14	Digital	8bits					
Function 15	Digital	8bits					
Function 16	Digital	8bits					

Table 12: Analog Commands

RF Command In		Transmitter PCB Connections	
Function	RF Command	XLTX I/O	MLTX2 I/O
Function1	Analog	Analog0-Pot0	Analog0-Pot0
Function2	Analog	Analog1-Pot1	Analog1-Pot1
Function3	Analog		
Function4	Analog		
Function5	Analog		
Function6	Analog		
Function7	Analog		
Function8	Analog		
Function9	Analog	Analog2/A	Analog2/A
Function10	Analog	Analog3/B	Analog3/B
Function11	Analog	Analog4/C	Analog4/C
Function12	Analog	Analog5/D	Analog5/D
Function13	Analog	Analog6/E	Analog6/E
Function14	Analog		
Function15	Analog		
Function16	Analog		

7.2.3 Transmitter Button Layout

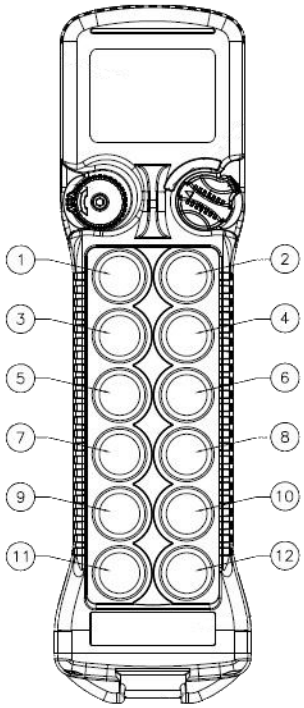


Figure 33: Flex VUE

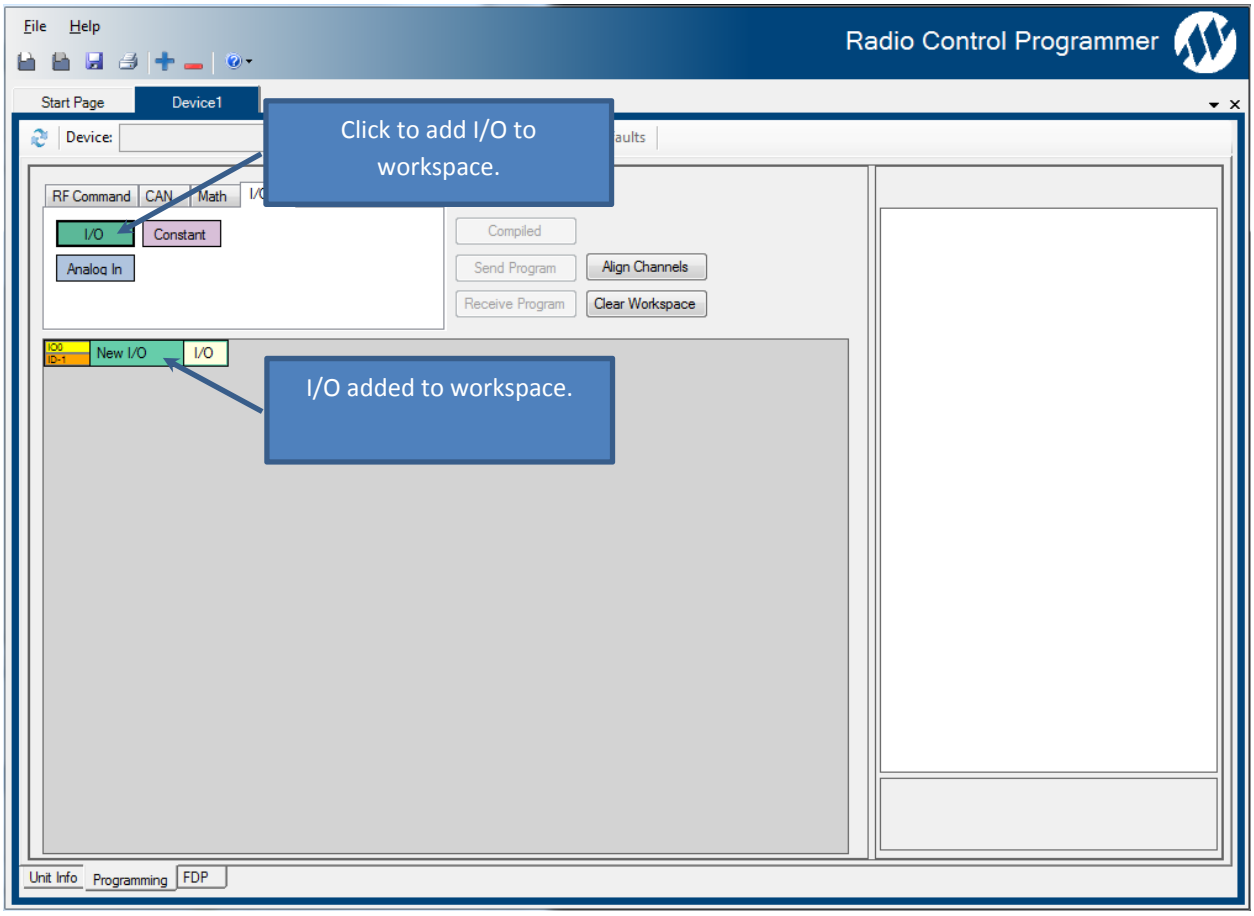
Image Button Number	Function Number (see Transmitter Radio Message Mapping)
1	Function 1
2	Function 2
3	Function 3
4	Function 4
5	Function 5
6	Function 6
7	Function 7
8	Function 8
9	Function 9
10	Function 10
11	Function 11
12	Function 12

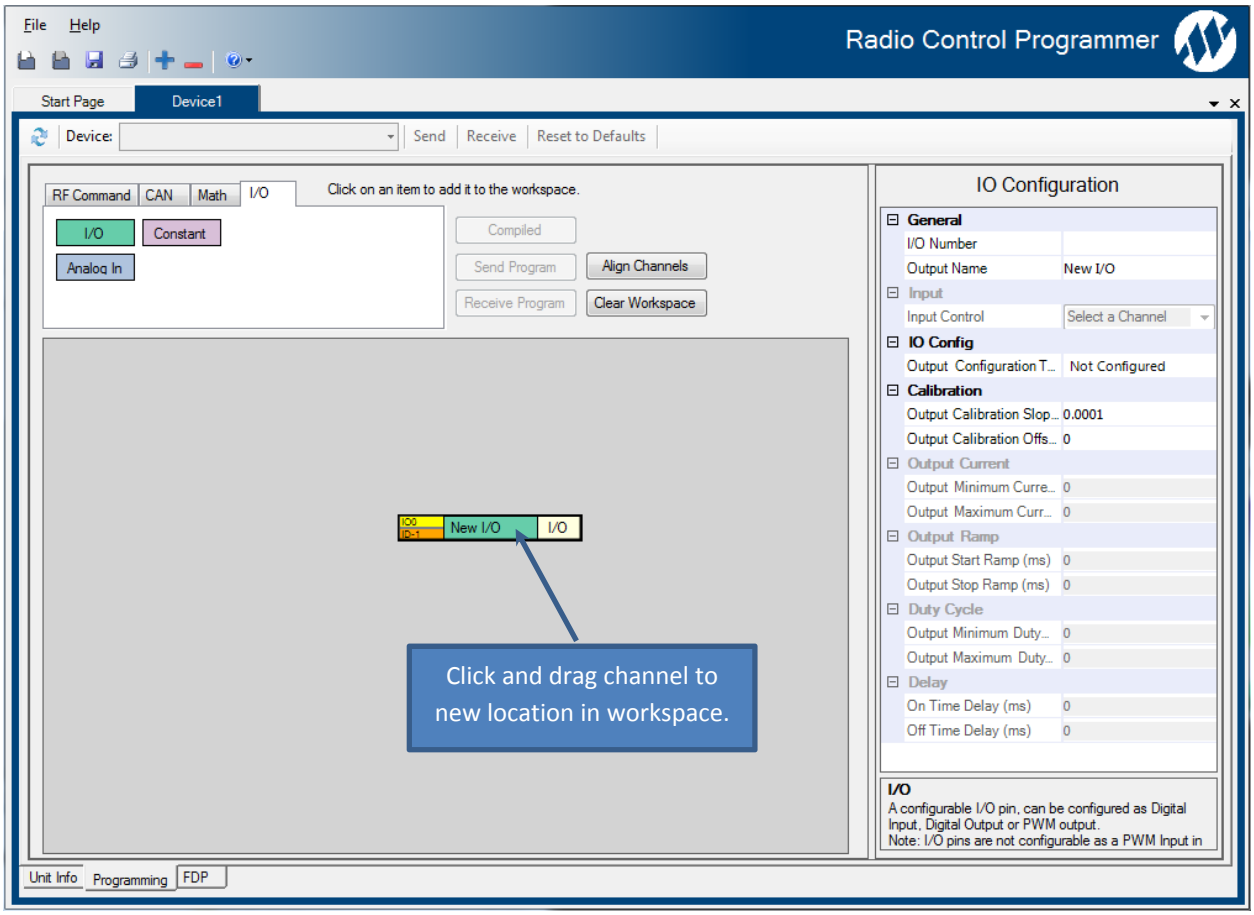
The Flex EX and Flex EM transmitters also follow the same button layout as the Flex VUE shown above.

7.3 Examples

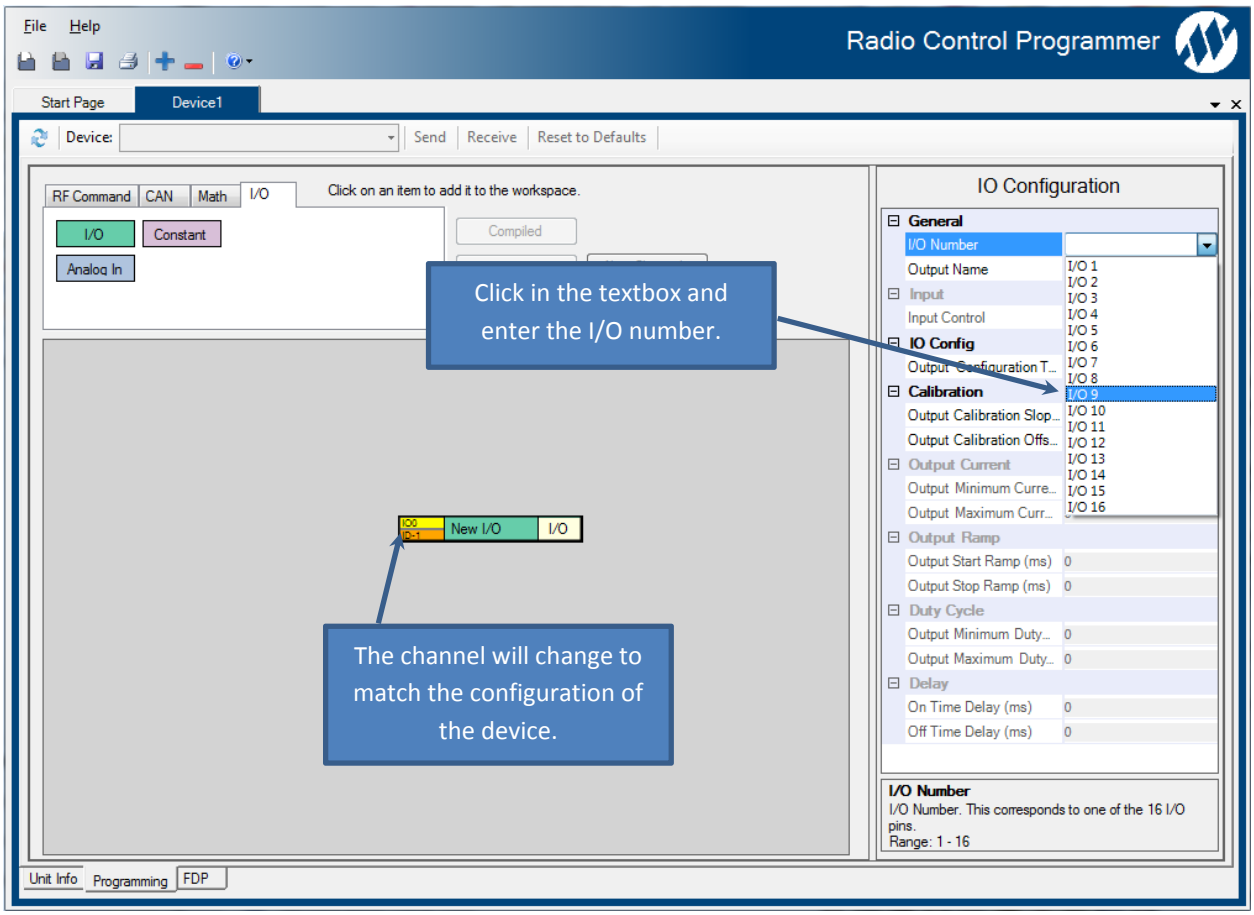
7.3.1 Digital Input to Digital Output

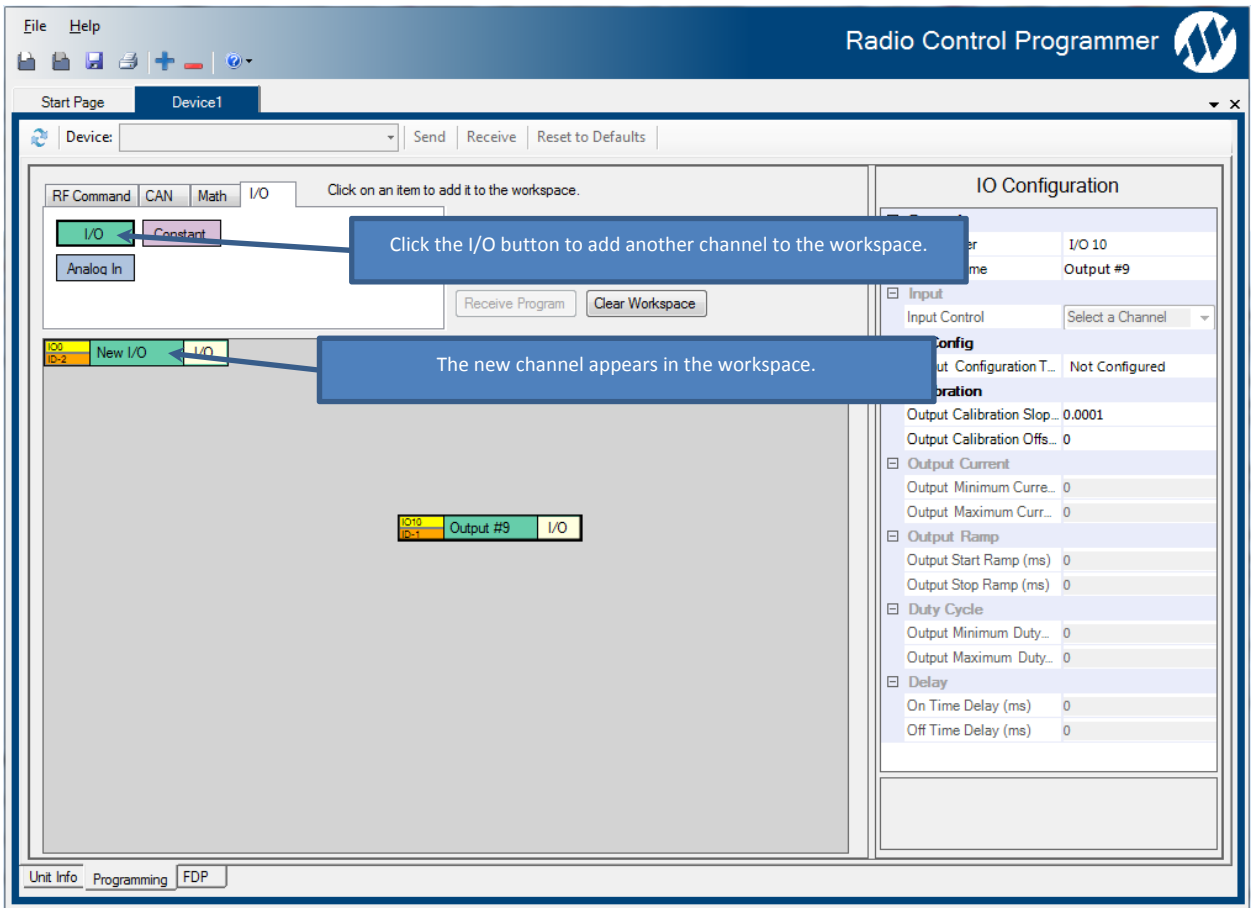
This section will show a very basic mapping which will take a digital input on a device and map it directly to a digital output on a device. A mapping of this nature will be uncommon, but this is intended to show the basics of how programming a device is accomplished. Further sections will get into more detail with additional mapping options and features.





When the project was created, the option to read device data was checked, so the device configuration will be used when a selection is made.

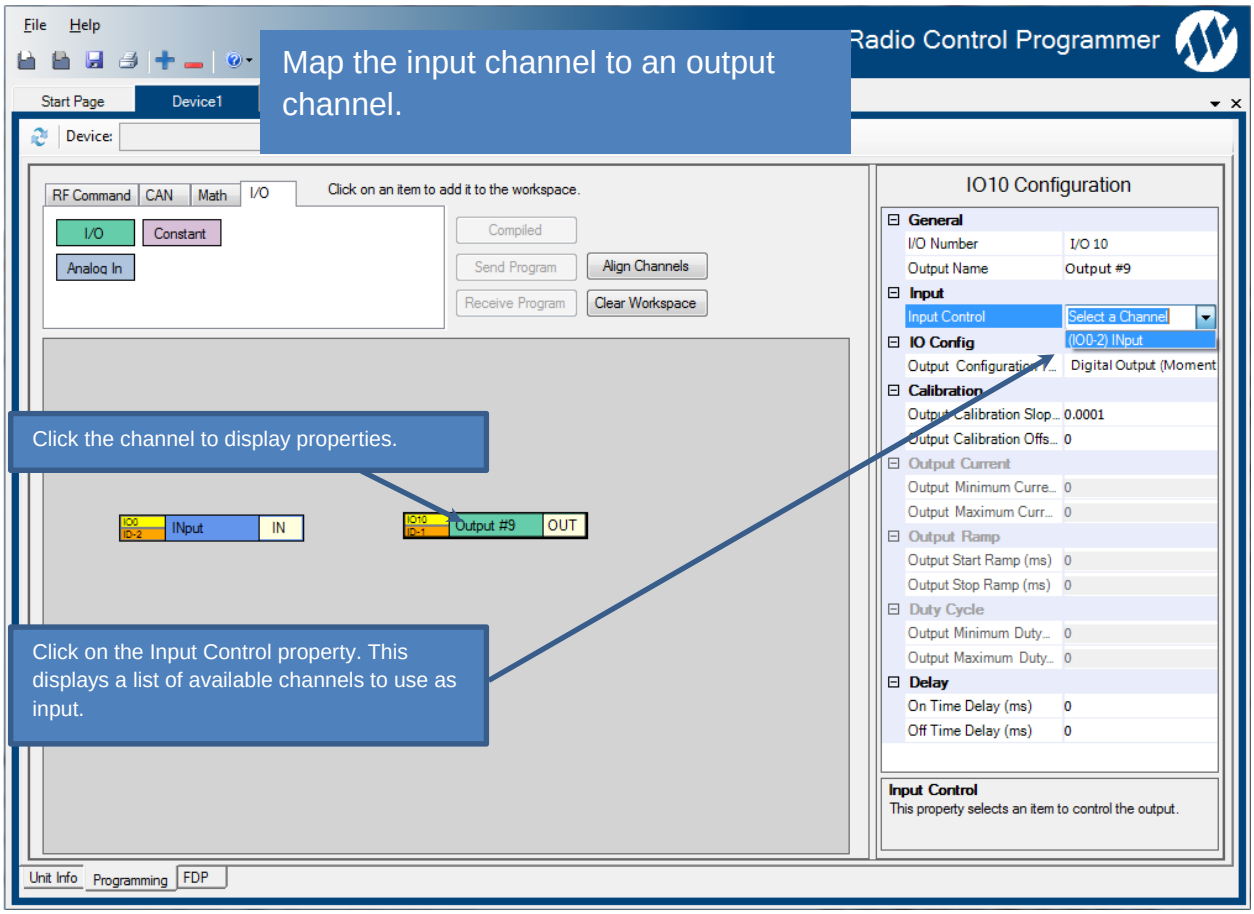

File
Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
I/O
Constant
Analog In
Compiled
Click in the textbox and enter the I/O number.
New I/O
I/O
The channel will change to match the configuration of the device.
IO Configuration
General
I/O Number
Output Name
Input
Input Control
IO Config
Output Configuration T...
Calibration
Output Calibration Slop...
Output Calibration Offs...
Output Current
Output Minimum Curre...
Output Maximum Curr...
Output Ramp
Output Start Ramp (ms)
Output Stop Ramp (ms)
Duty Cycle
Output Minimum Duty...
Output Maximum Duty...
Delay
On Time Delay (ms)
Off Time Delay (ms)
I/O 1
I/O 2
I/O 3
I/O 4
I/O 5
I/O 6
I/O 7
I/O 8
I/O 9
I/O 10
I/O 11
I/O 12
I/O 13
I/O 14
I/O 15
I/O 16
I/O Number
I/O Number. This corresponds to one of the 16 I/O pins.
Range: 1 - 16
Unit Info
Programming
FDP

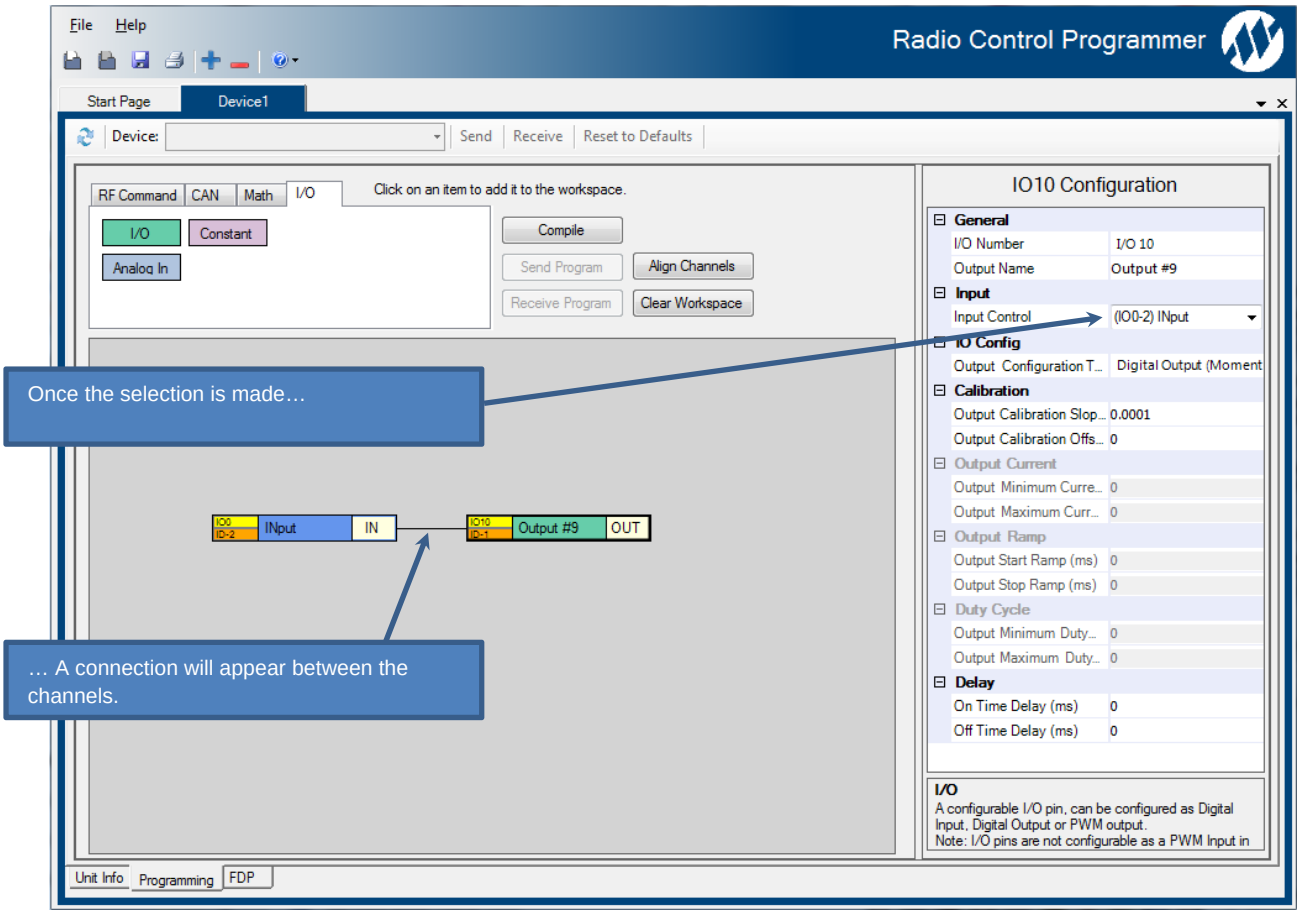


Next steps: (same steps as done for Output #9 channel)

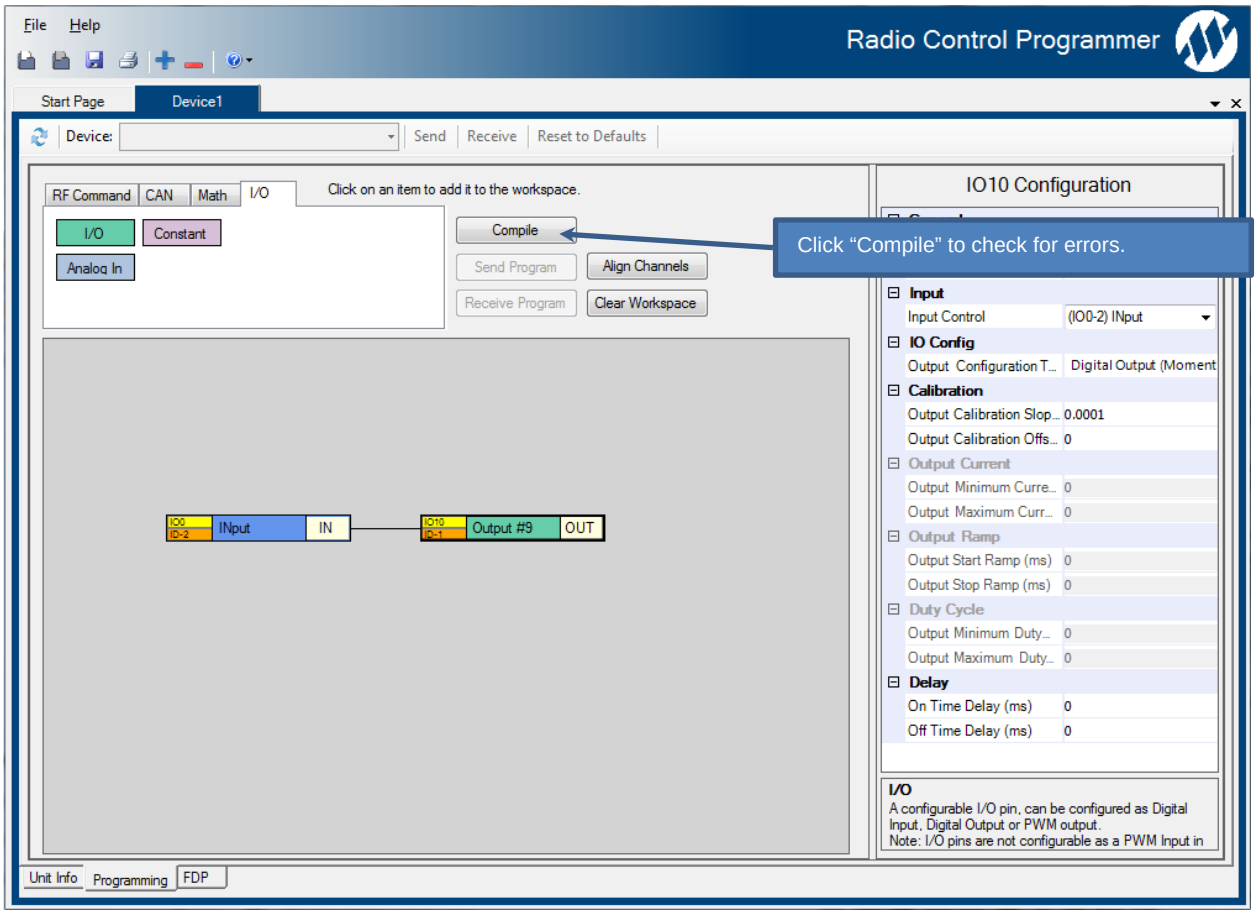
- Drag the new channel near the Output #9 channel.
- Select the I/O number that matches the configuration you are creating.

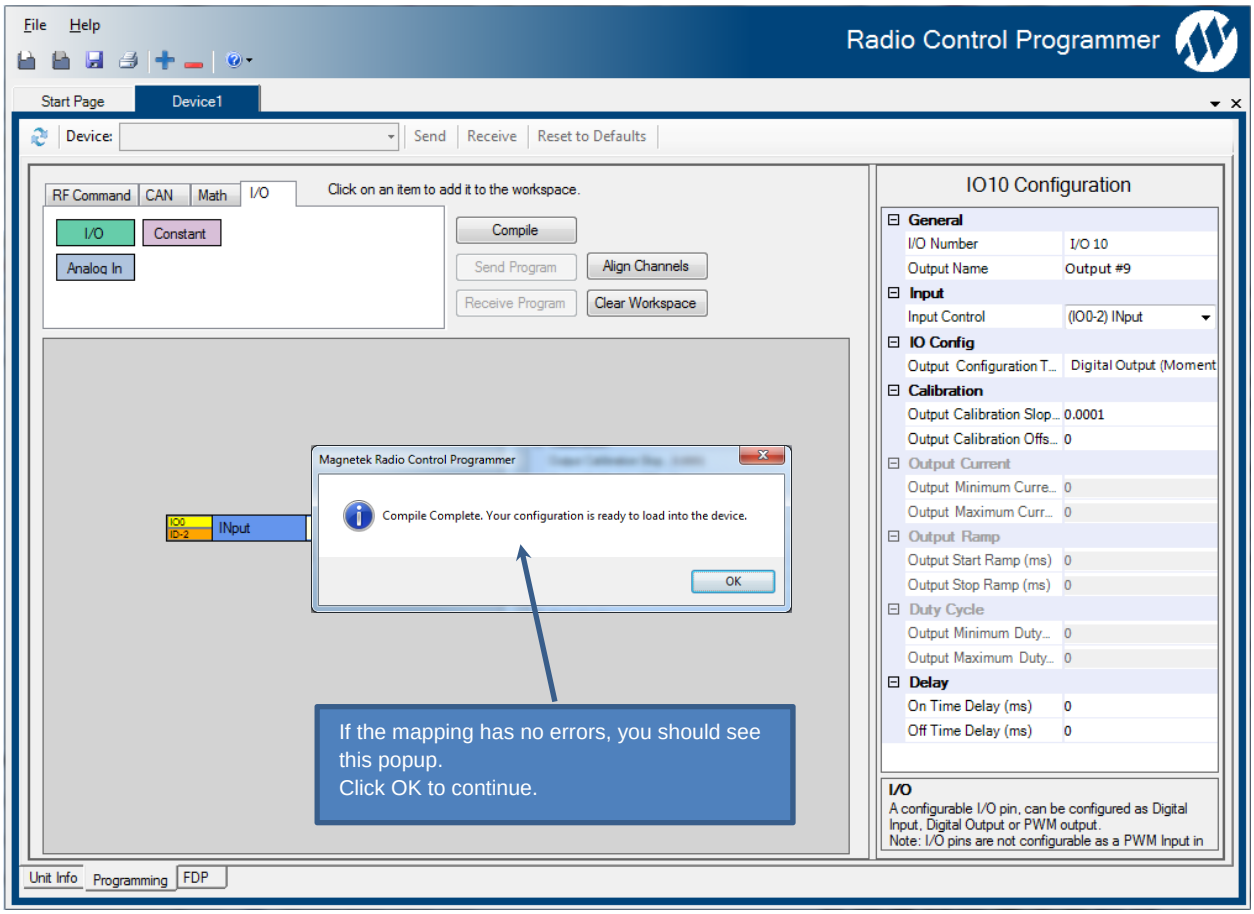
The next screenshot will show these step already completed.


File
Help
Radio Control Programmer
Map the input channel to an output channel.
Start Page
Device1
Device:
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
I/O
Constant
Analog In
Compiled
Send Program
Align Channels
Receive Program
Clear Workspace
IO10 Configuration
General
I/O Number
I/O 10
Output Name
Output #9
Input
Input Control
Select a Channel
(IO0-2) INput
IO Config
Output Configuration
Digital Output (Moment
Calibration
Output Calibration Slop...
0.0001
Output Calibration Offs...
0
Output Current
Output Minimum Curre...
Output Maximum Curr...
Output Ramp
Output Start Ramp (ms)
Output Stop Ramp (ms)
Duty Cycle
Output Minimum Duty...
Output Maximum Duty...
Delay
On Time Delay (ms)
Off Time Delay (ms)
Click the channel to display properties.
INput
IN
Output #9
OUT
Click on the Input Control property. This displays a list of available channels to use as input.
Input Control
This property selects an item to control the output.
Unit Info
Programming
FDP



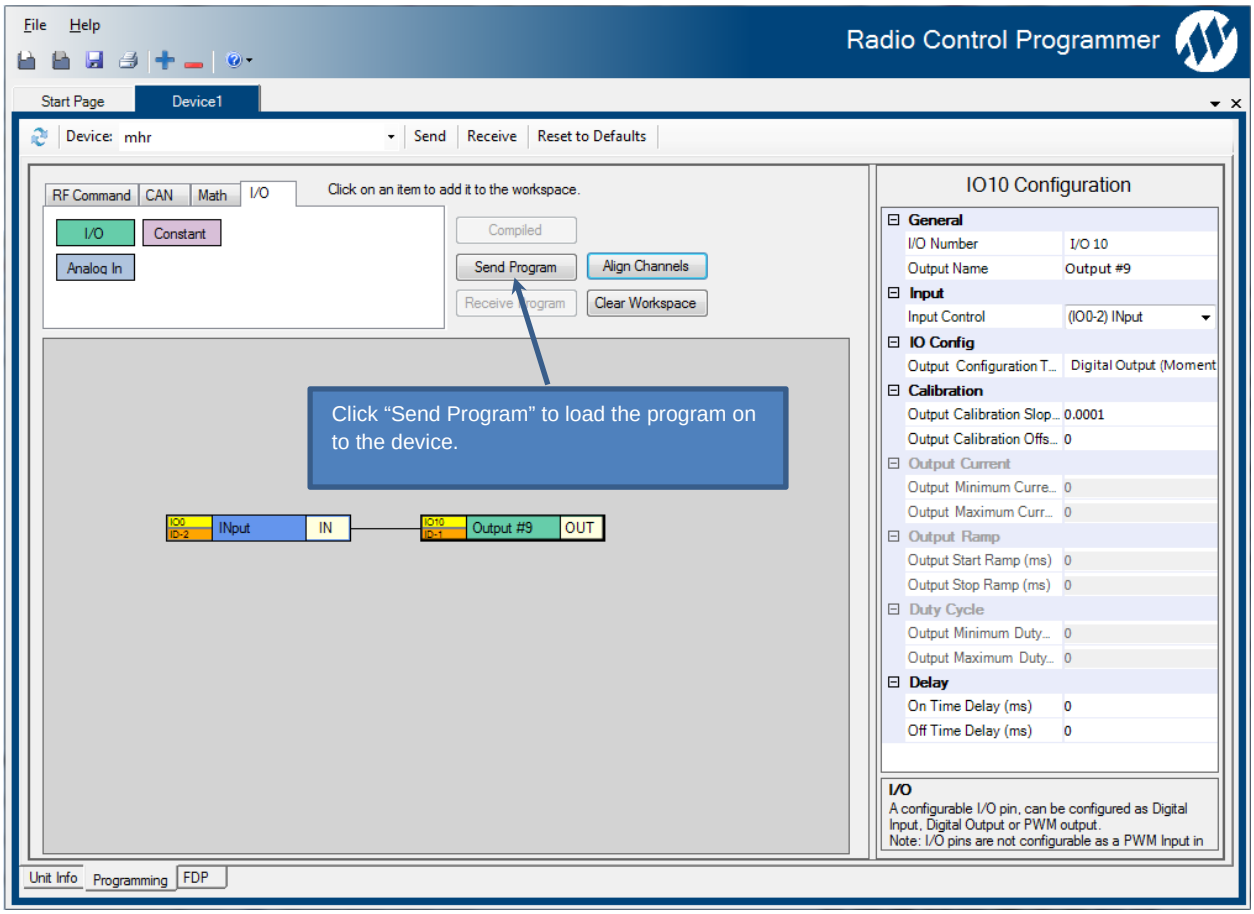
Now the configuration is ready to compile and load onto the device.

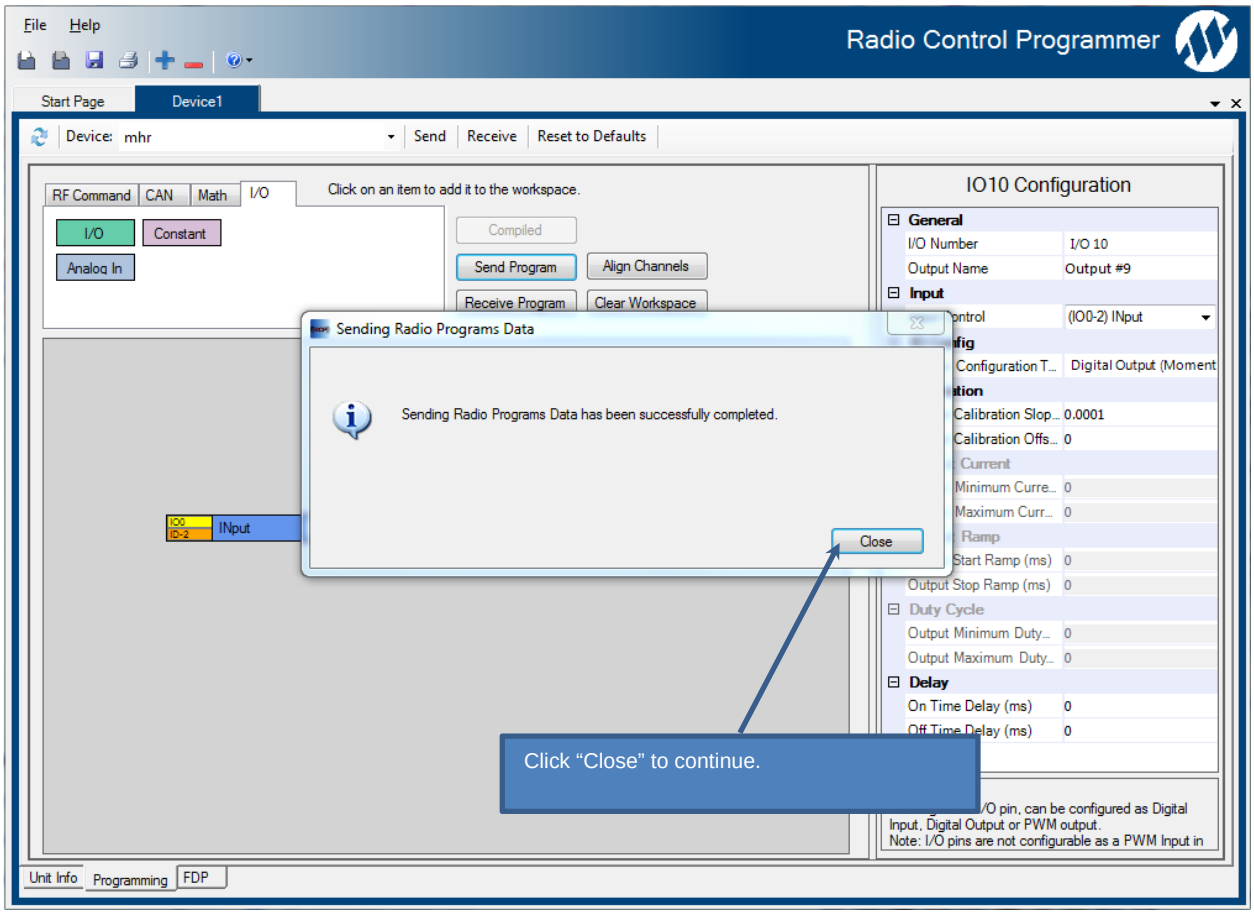

File
Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
I/O
Constant
Analog In
Compile
Send Program
Align Channels
Receive Program
Clear Workspace
Click “Compile” to check for errors.
IO10 Configuration
Input
Input Control
(IO0-2) INput
IO Config
Output Configuration T...
Digital Output (Moment
Calibration
Output Calibration Slop...
0.0001
Output Calibration Offs...
0
Output Current
Output Minimum Curre...
Output Maximum Curr...
Output Ramp
Output Start Ramp (ms)
Output Stop Ramp (ms)
Duty Cycle
Output Minimum Duty...
Output Maximum Duty...
Delay
On Time Delay (ms)
Off Time Delay (ms)
I/O
A configurable I/O pin, can be configured as Digital Input, Digital Output or PWM output.
Note: I/O pins are not configurable as a PWM Input in
IO0
IO-2
INput
IN
IO10
IO-1
Output #9
OUT
Unit Info
Programming
FDP



The “Compile” button runs a series of checks on the mapping that was created prior to allowing the configuration to be loaded onto the device.

Now the program is ready to send and load onto the device.


File
Help
Radio Control Programmer
Start Page
Device1
Device: mhr
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
I/O
Constant
Analog In
Compiled
Send Program
Align Channels
Receive Program
Clear Workspace
Click “Send Program” to load the program on to the device.
IO0 IO-2
INput
IN
IO10 IO-1
Output #9
OUT
IO10 Configuration
General
I/O Number
I/O 10
Output Name
Output #9
Input
Input Control
(IO0-2) INput
IO Config
Output Configuration T...
Digital Output (Moment
Calibration
Output Calibration Slop...
0.0001
Output Calibration Offs...
0
Output Current
Output Minimum Curre...
0
Output Maximum Curr...
0
Output Ramp
Output Start Ramp (ms)
0
Output Stop Ramp (ms)
0
Duty Cycle
Output Minimum Duty...
0
Output Maximum Duty...
0
Delay
On Time Delay (ms)
0
Off Time Delay (ms)
0
I/O
A configurable I/O pin, can be configured as Digital Input, Digital Output or PWM output.
Note: I/O pins are not configurable as a PWM Input in
Unit Info
Programming
FDP



At this point the mapping has been loaded onto the device, and it should be running the loaded mapping.

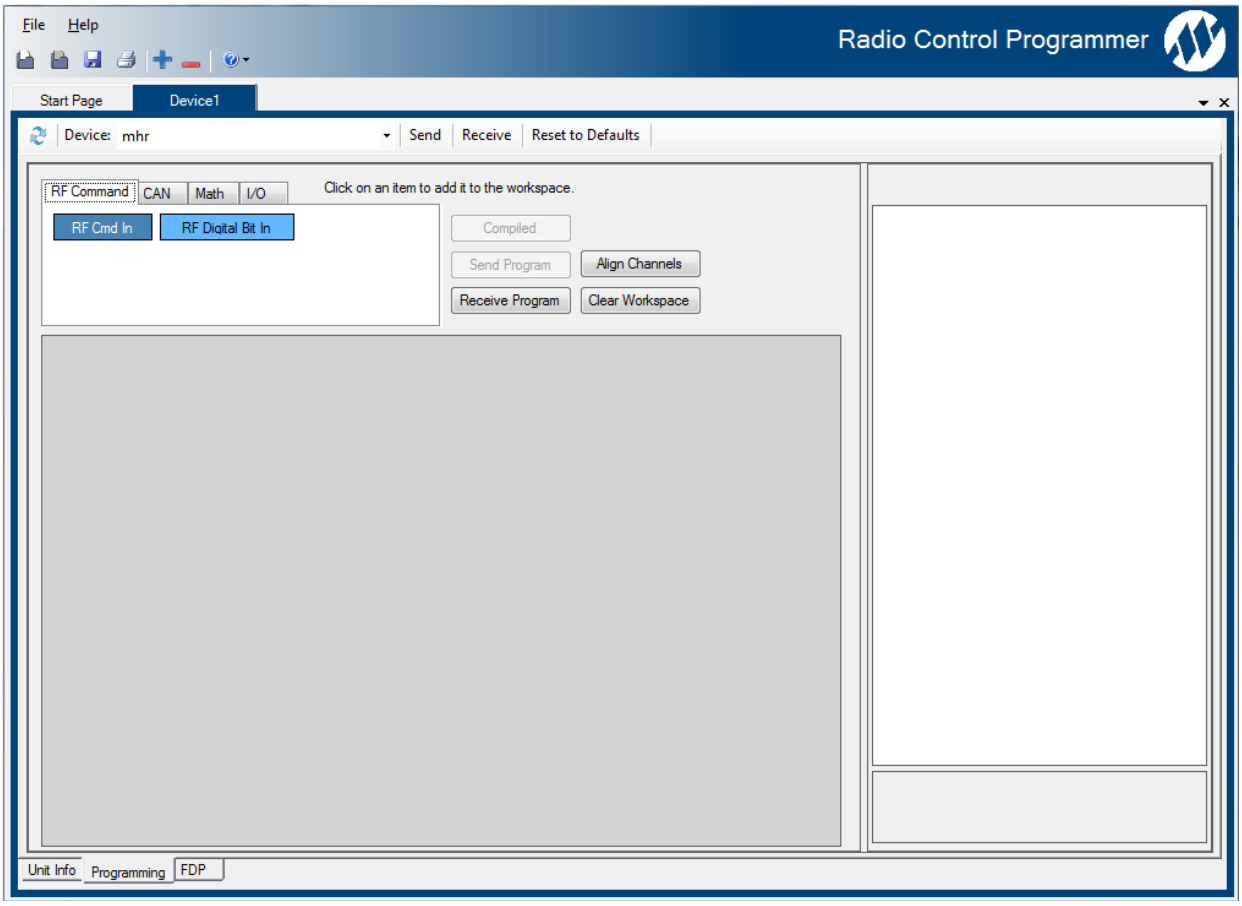
7.3.2 Mapping an Incoming RF Message

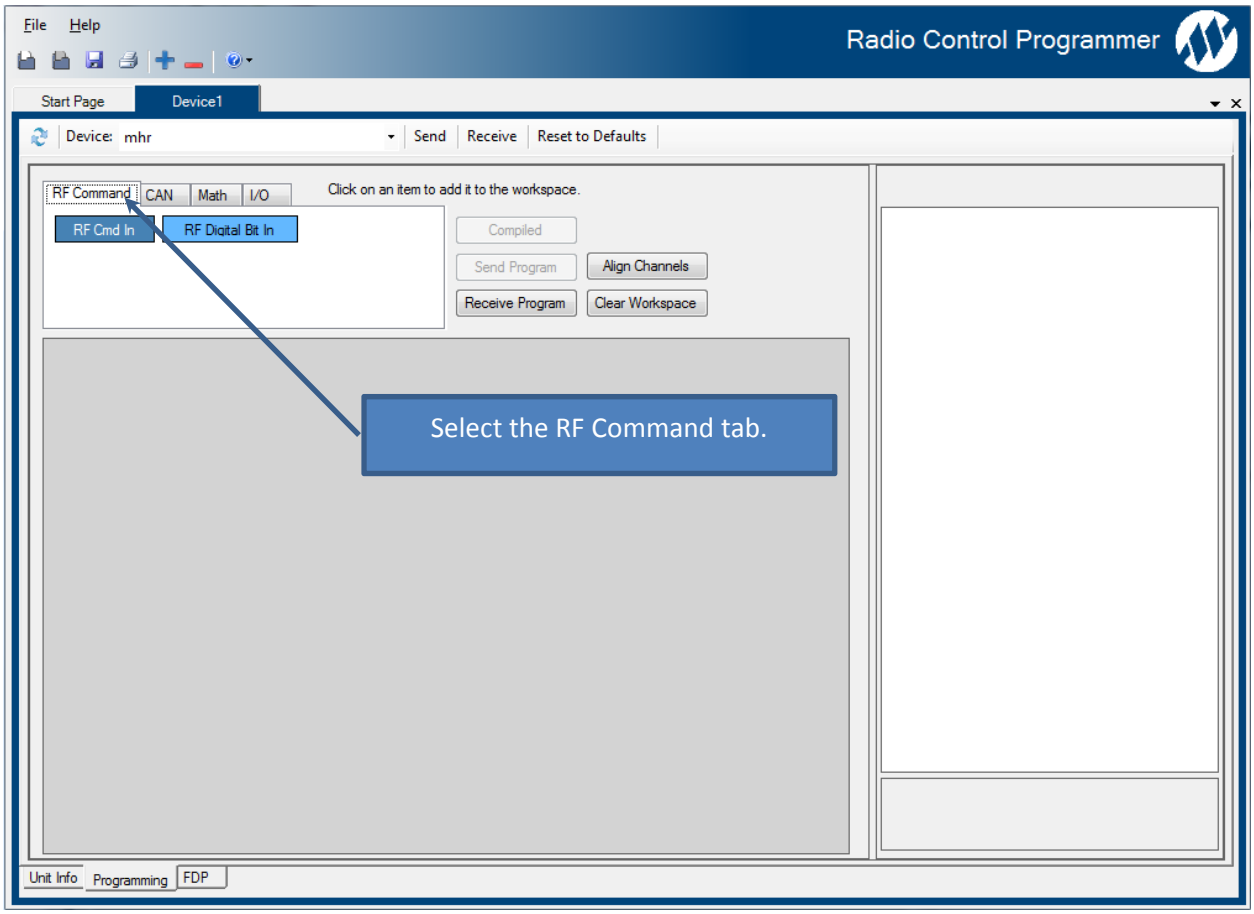
This section will show how to map an incoming radio message.

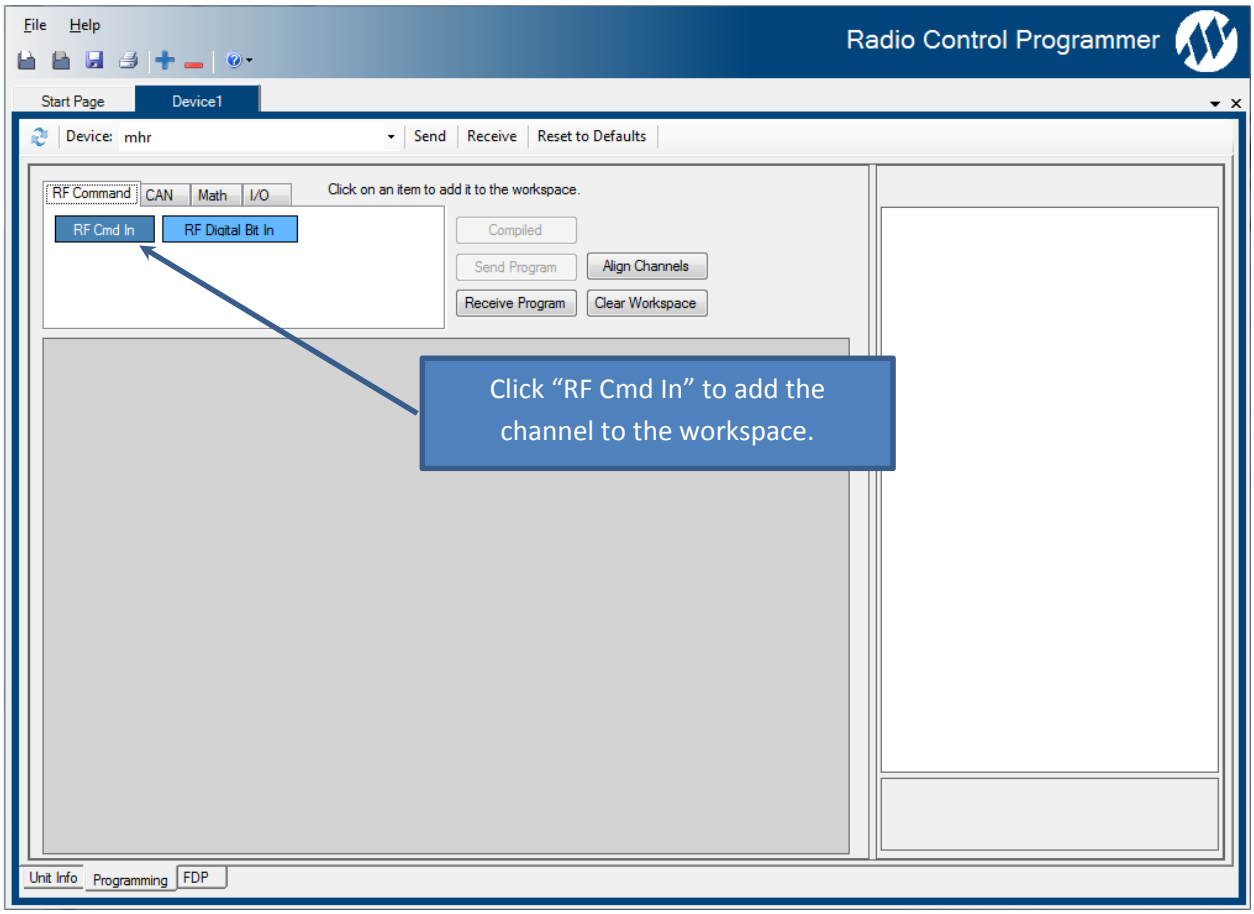
Please refer to Table 10 in Section 7.2.2 when mapping the incoming RF messages.

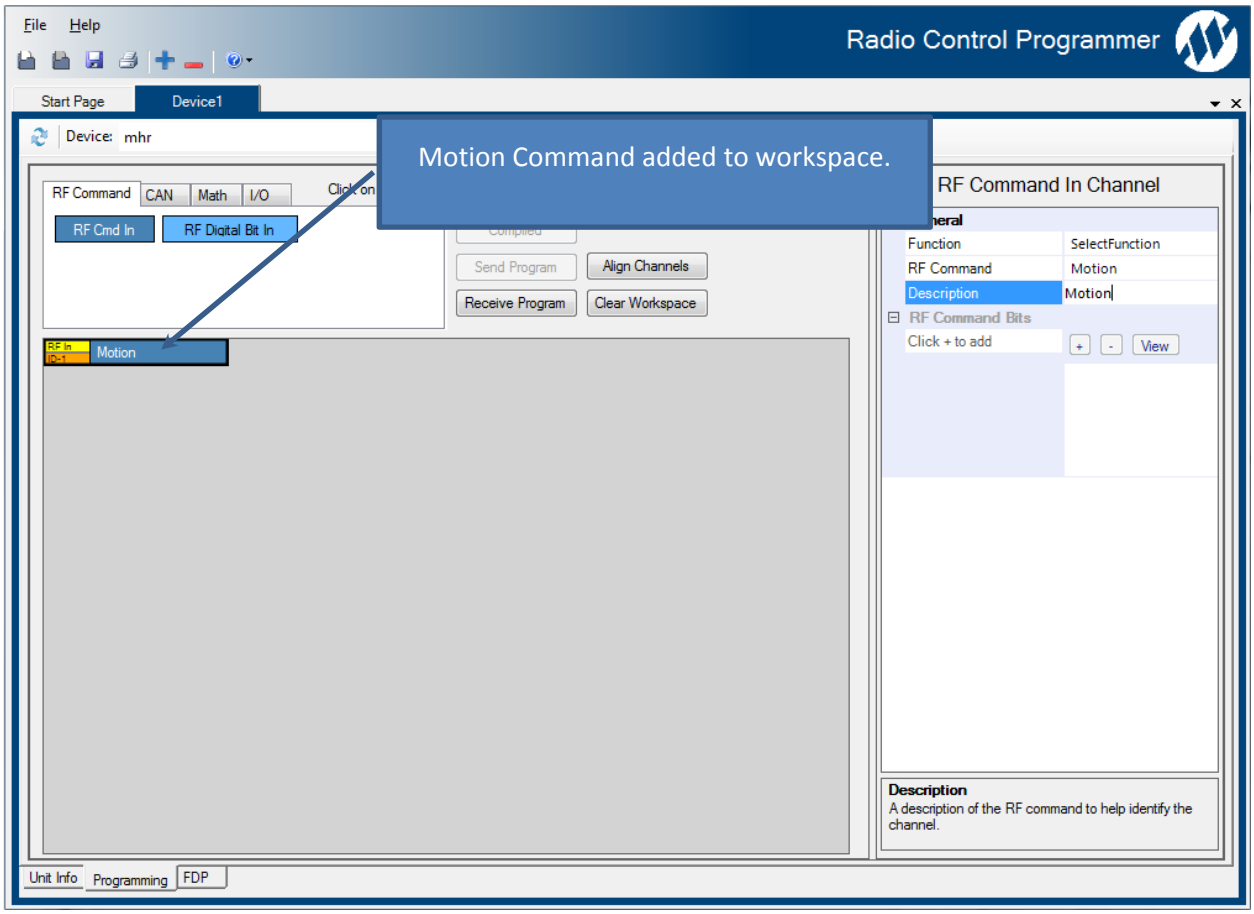
This example will map button 1 of a Flex VUE transmitter to an output configured as PWM open loop on an MHR receiver, but this can be mapped to any output type on any of the supported programmable devices.

Start by creating a new project with an MHR device selected and allow the device configuration to be read. This is the same process explained in Section 5. Once the project is started, navigate to the Programming Tab across the bottom of the UI.

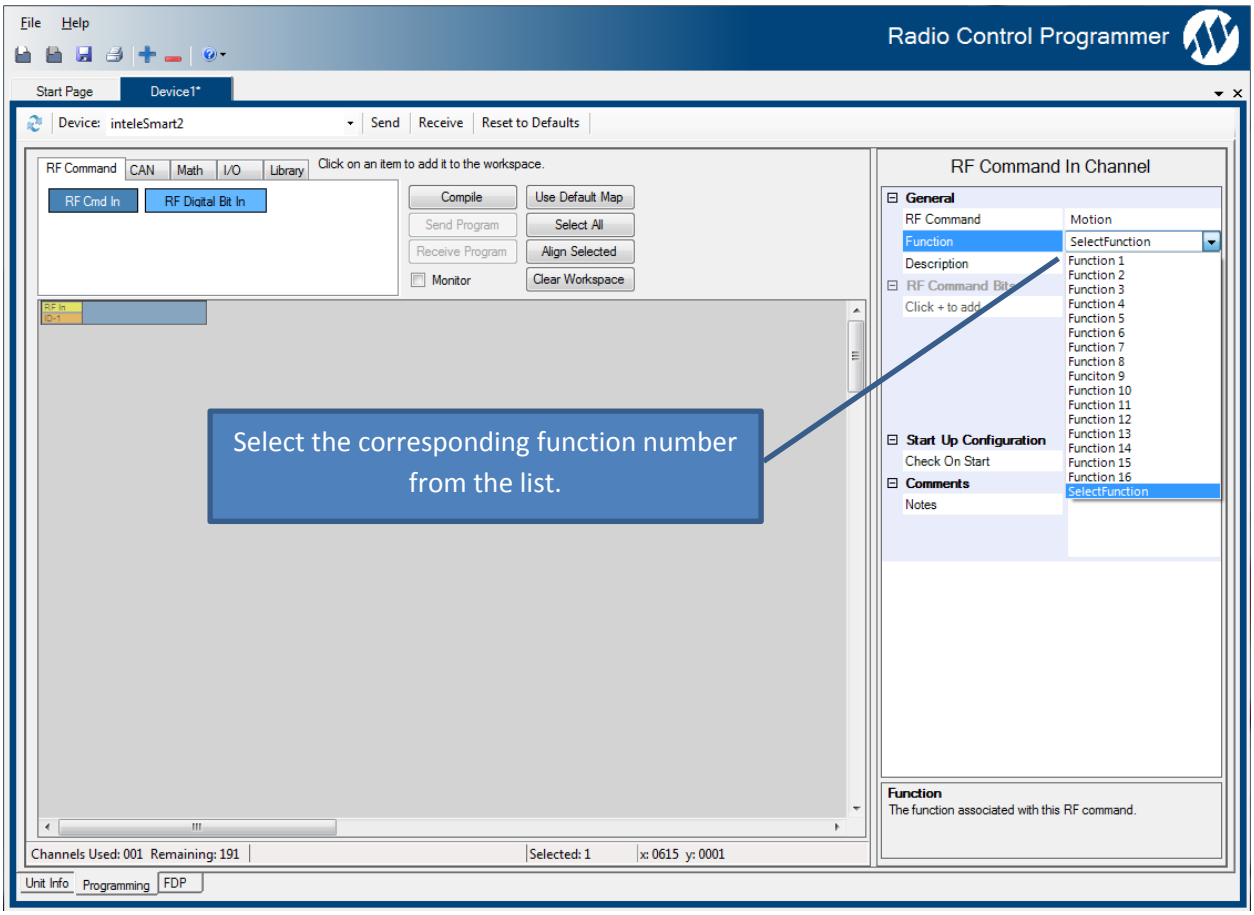


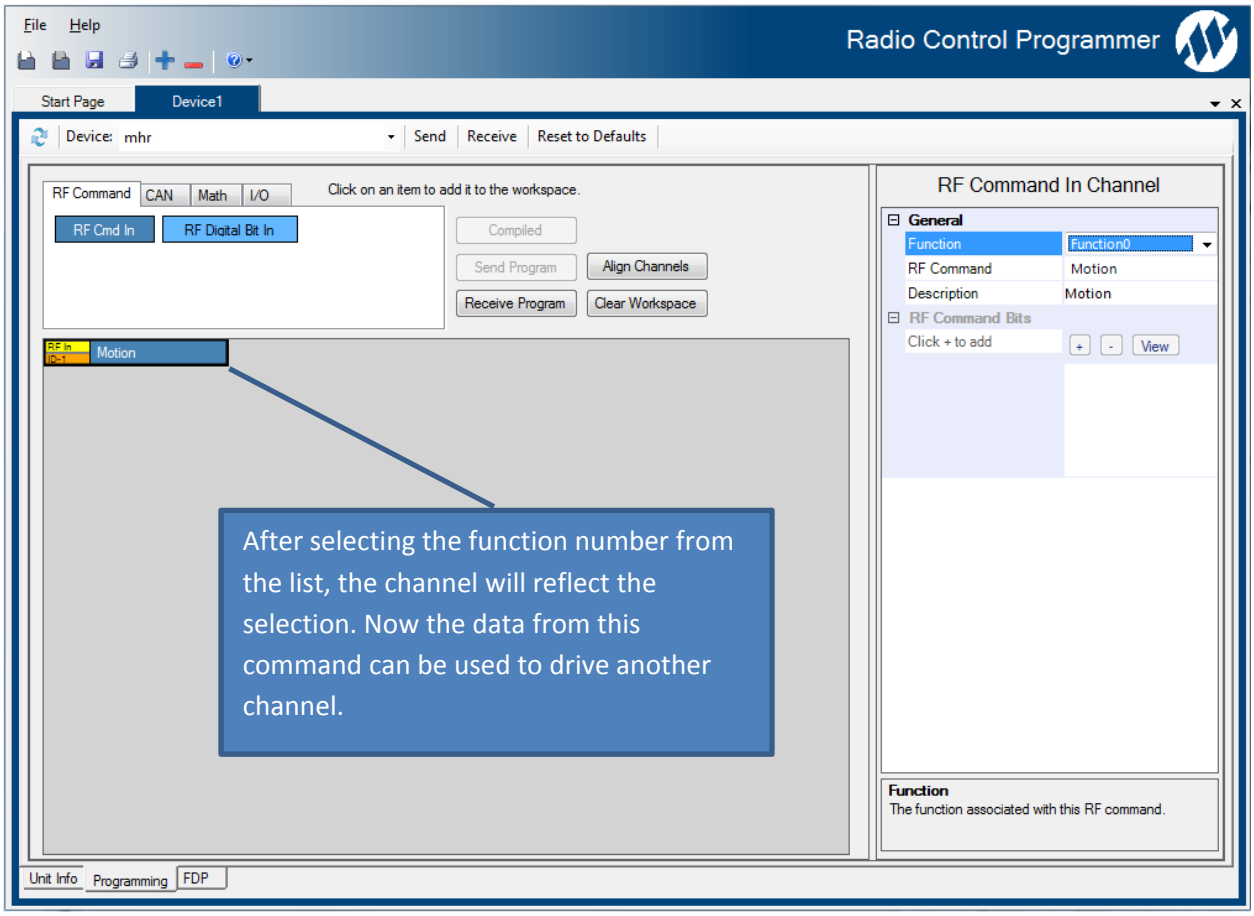

File
Help
Radio Control Programmer
Start Page
Device1
Device: mhr
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
RF Cmd In
RF Digital Bit In
Compiled
Send Program
Align Channels
Receive Program
Clear Workspace
Select the RF Command tab.
Unit Info
Programming
FDP

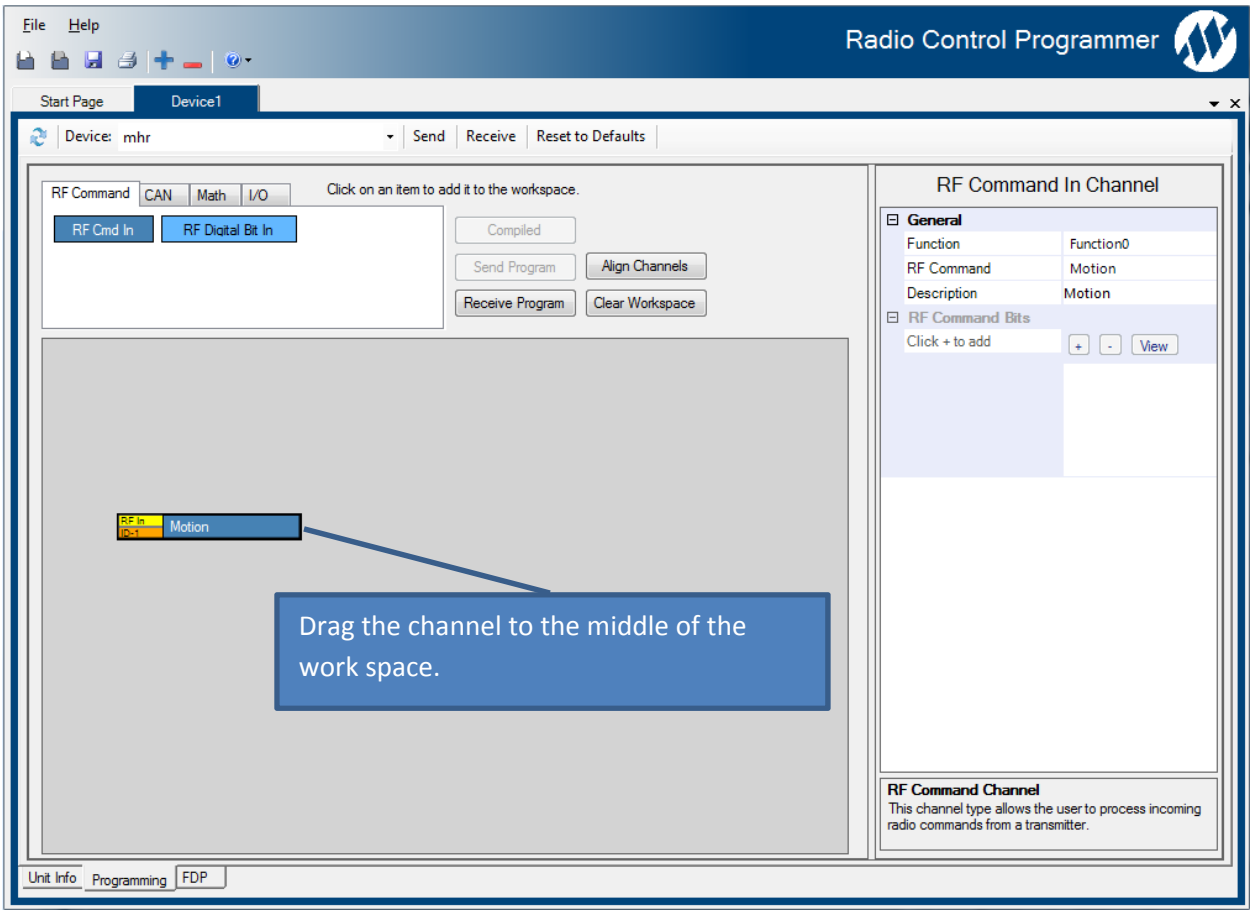

File
Help
Radio Control Programmer
Start Page
Device1
Device: mhr
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
RF Cmd In
RF Digital Bit In
Compiled
Send Program
Align Channels
Receive Program
Clear Workspace
Click “RF Cmd In” to add the channel to the workspace.
Unit Info
Programming
FDP



Now the incoming message command should be selected. Based on Table 11 in Section 7.2.2, button 1 of the Flex VUE maps to a Motion command with function 10. That information allows the user to configure the channel accordingly.


File Help
Radio Control Programmer
Start Page
Device1*
Device: inteleSmart2
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Library
Click on an item to add it to the workspace.
RF Cmd In
RF Digital Bit In
Compile
Use Default Map
Send Program
Select All
Receive Program
Align Selected
Monitor
Clear Workspace
Select the corresponding function number from the list.
RF Command In Channel
General
RF Command
Motion
Function
SelectFunction
Description
Function 1
Function 2
Function 3
Function 4
Function 5
Function 6
Function 7
Function 8
Funciton 9
Function 10
Function 11
Function 12
Function 13
Function 14
Function 15
Function 16
SelectFunction
Start Up Configuration
Check On Start
Comments
Notes
Function
The function associated with this RF command.
Channels Used: 001 Remaining: 191
Selected: 1
x: 0615 y: 0001
Unit Info
Programming
FDP


File
Help
Radio Control Programmer
Start Page
Device1
Device: mhr
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
RF Cmd In
RF Digital Bit In
Compiled
Send Program
Align Channels
Receive Program
Clear Workspace
RF In
Motion
RF Command In Channel
General
Function
Function0
RF Command
Motion
Description
Motion
RF Command Bits
Click + to add
View
Function
The function associated with this RF command.
Unit Info
Programming
FDP
After selecting the function number from the list, the channel will reflect the selection. Now the data from this command can be used to drive another channel.



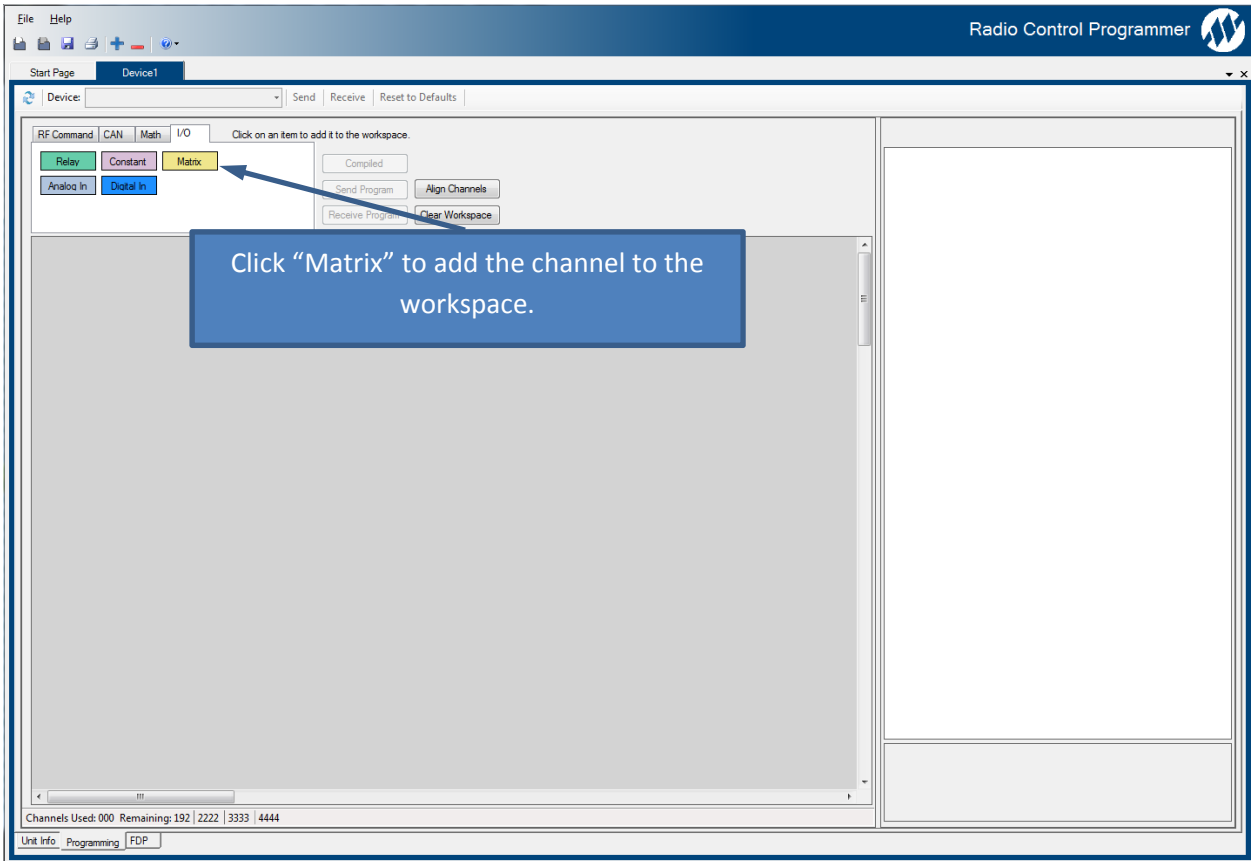
7.3.3 Using the Matrix Channel to Configure Relays

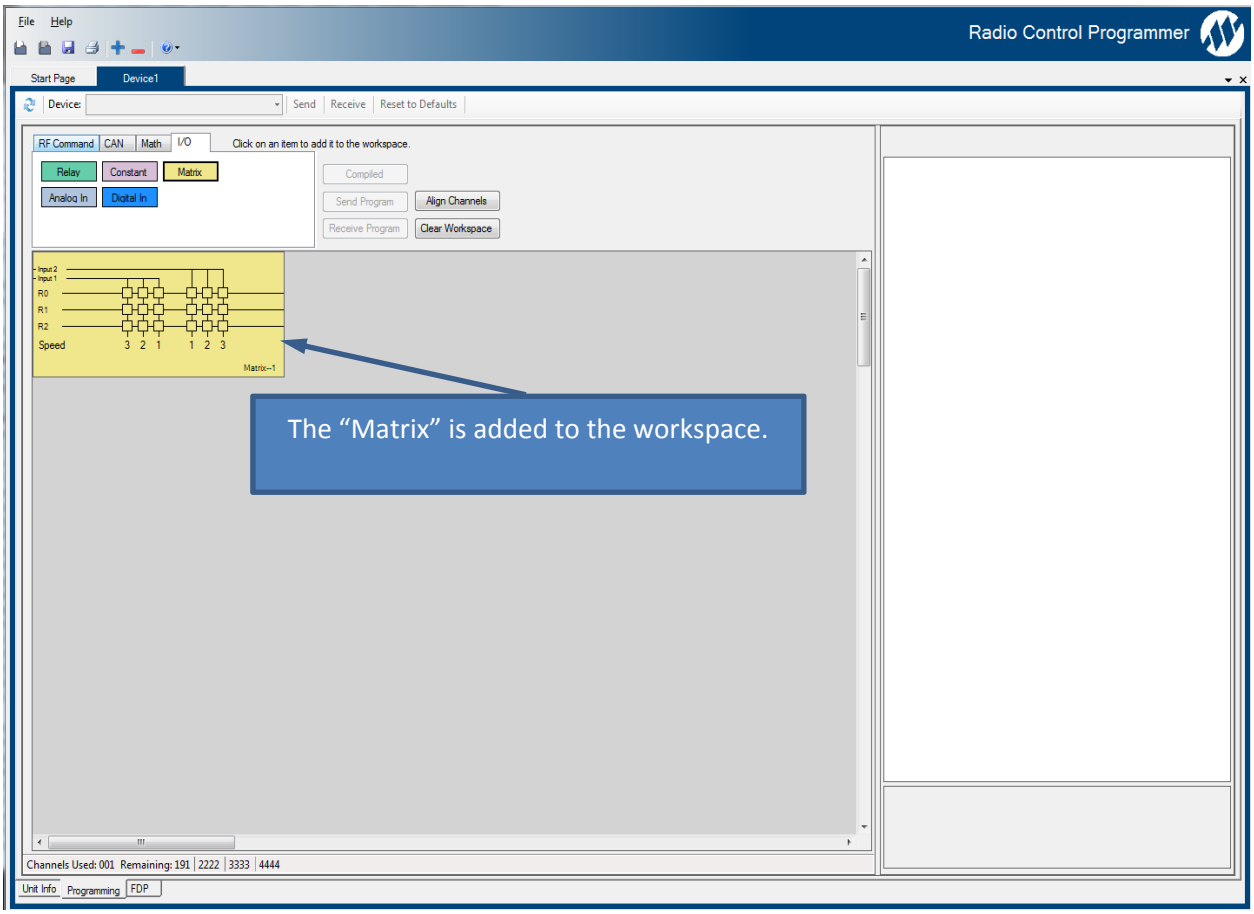
This section will show how to use the Matrix Channel to configure relays.

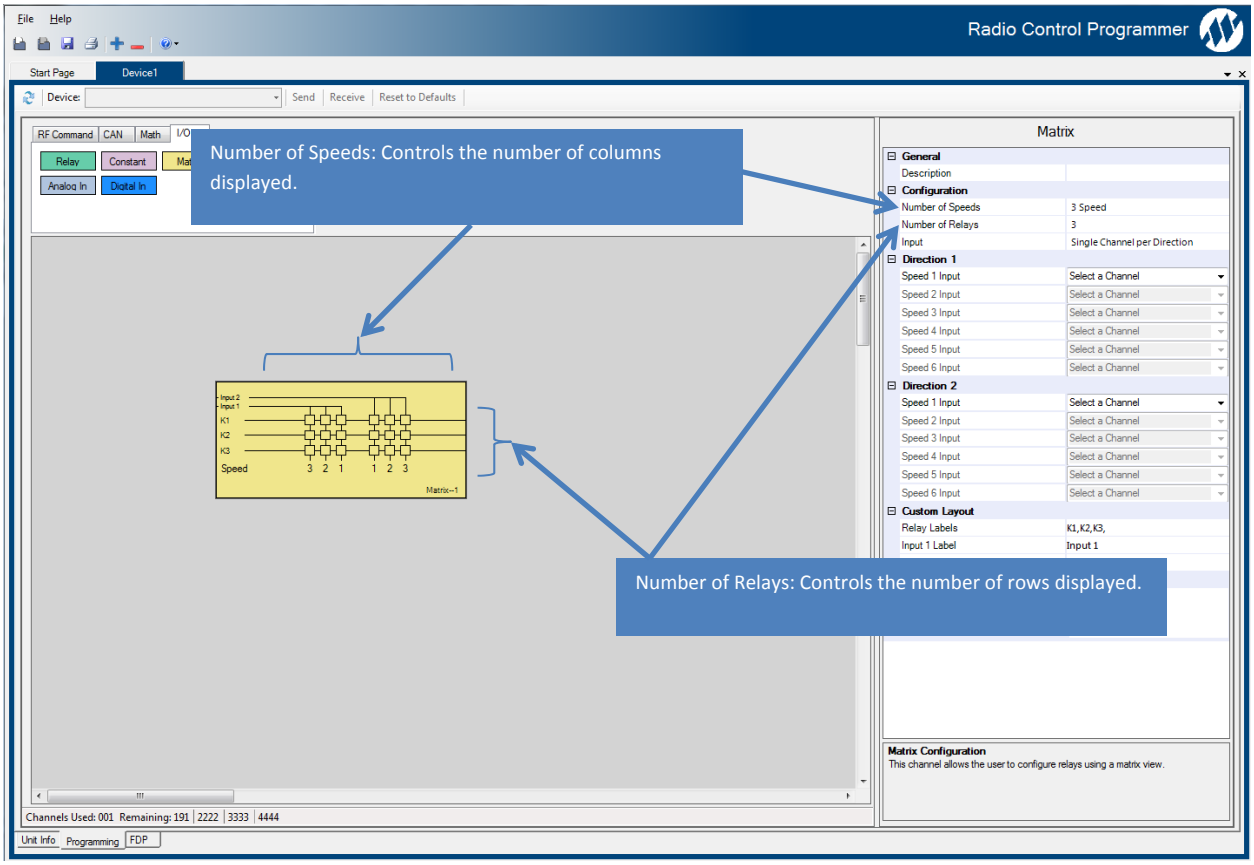
Please refer to Table 10 in Section 7.2.2 when mapping the incoming RF messages.

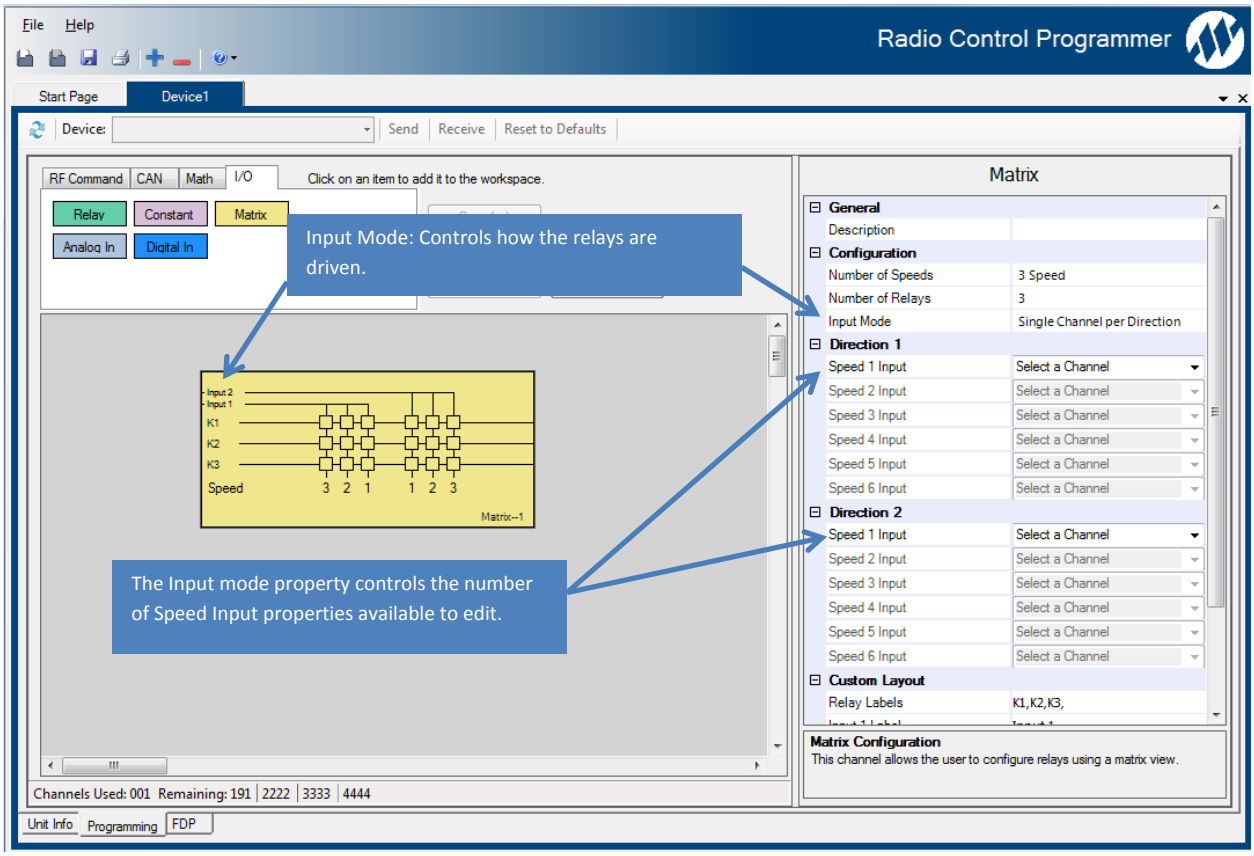
This example will map button 1 of a Flex VUE transmitter to an output/relay on an in*tele*Smart2 Receiver. The matrix and Analog to Step channels are only available on the in*tele*Smart2 Receiver.

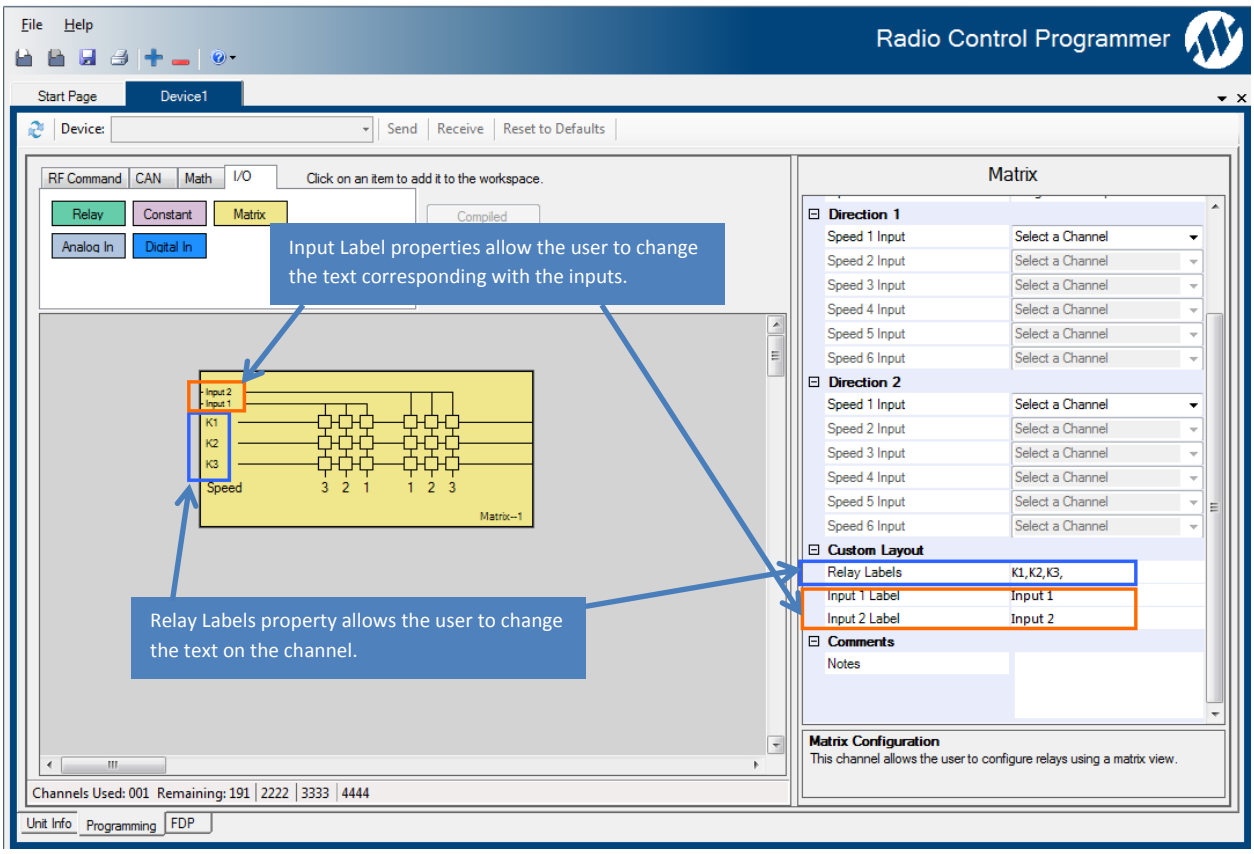
Start by creating a new project with an in*tele*Smart2 device selected and allow the device configuration to be read. This is the same process explained in Section 5. Once the project is started, navigate to the Programming Tab across the bottom of the UI.

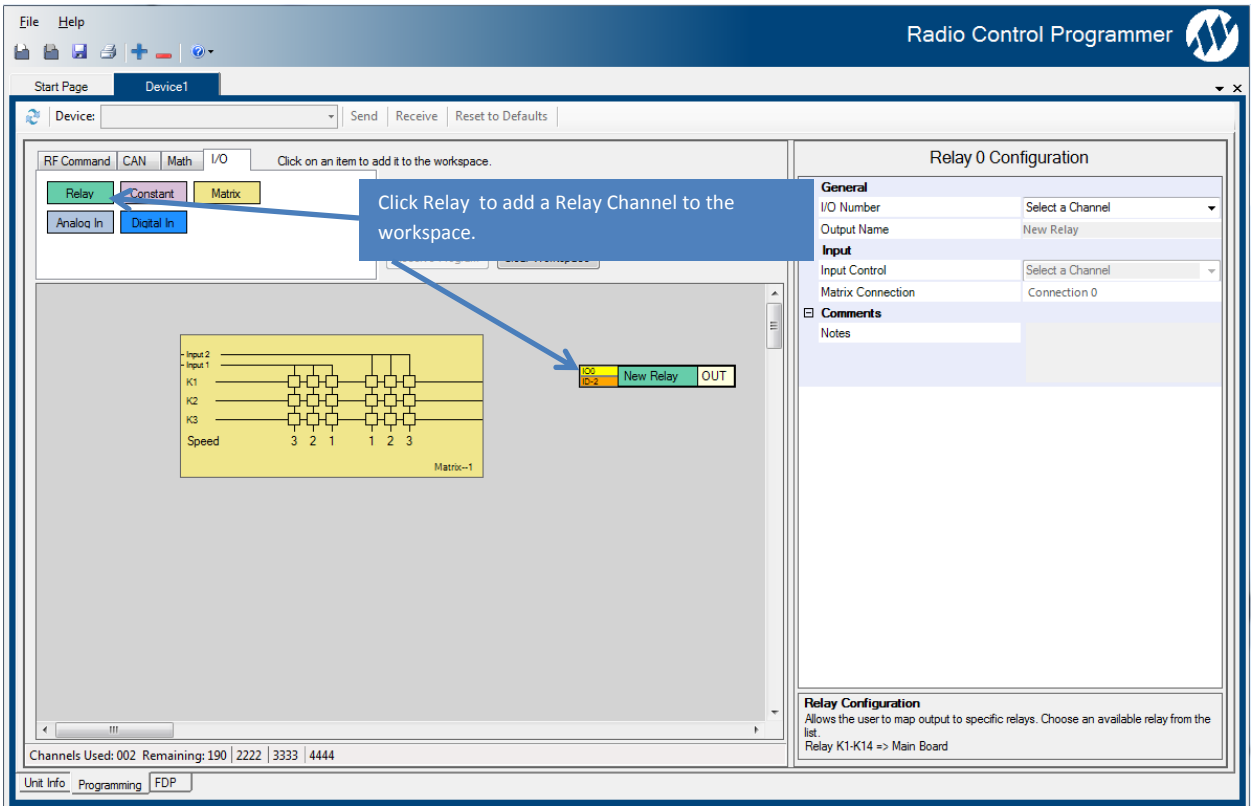

File
Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
Relay
Constant
Matrix
Analog In
Digital In
Compiled
Send Program
Align Channels
Receive Program
Clear Workspace
Click “Matrix” to add the channel to the workspace.
Channels Used: 000 Remaining: 192 | 2222 | 3333 | 4444
Unit Info
Programming
FDP

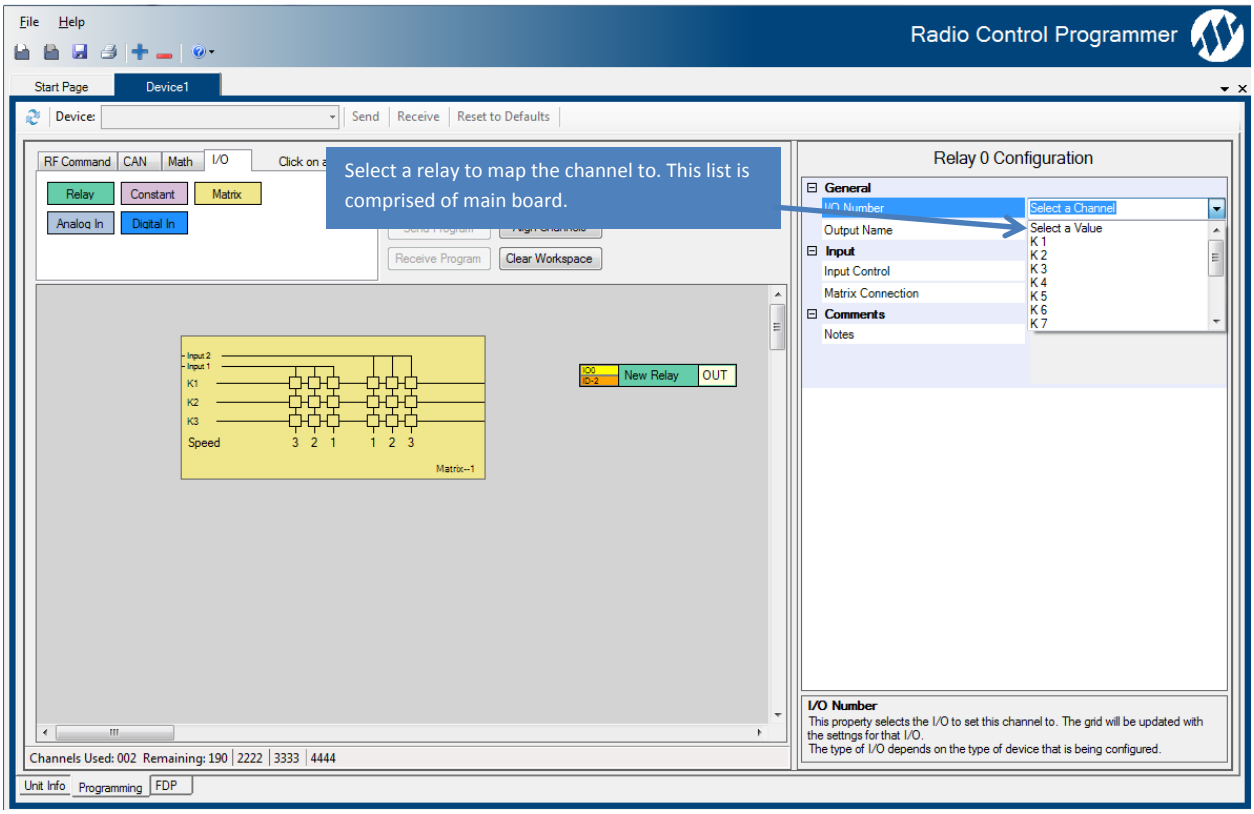

File
Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
Relay
Constant
Matrix
Analog In
Digital In
Compiled
Send Program
Align Channels
Receive Program
Clear Workspace
Input 2
Input 1
R0
R1
R2
Speed
3 2 1
1 2 3
Matrix--1
The “Matrix” is added to the workspace.
Channels Used: 001 Remaining: 191 | 2222 | 3333 | 4444
Unit Info
Programming
FDP

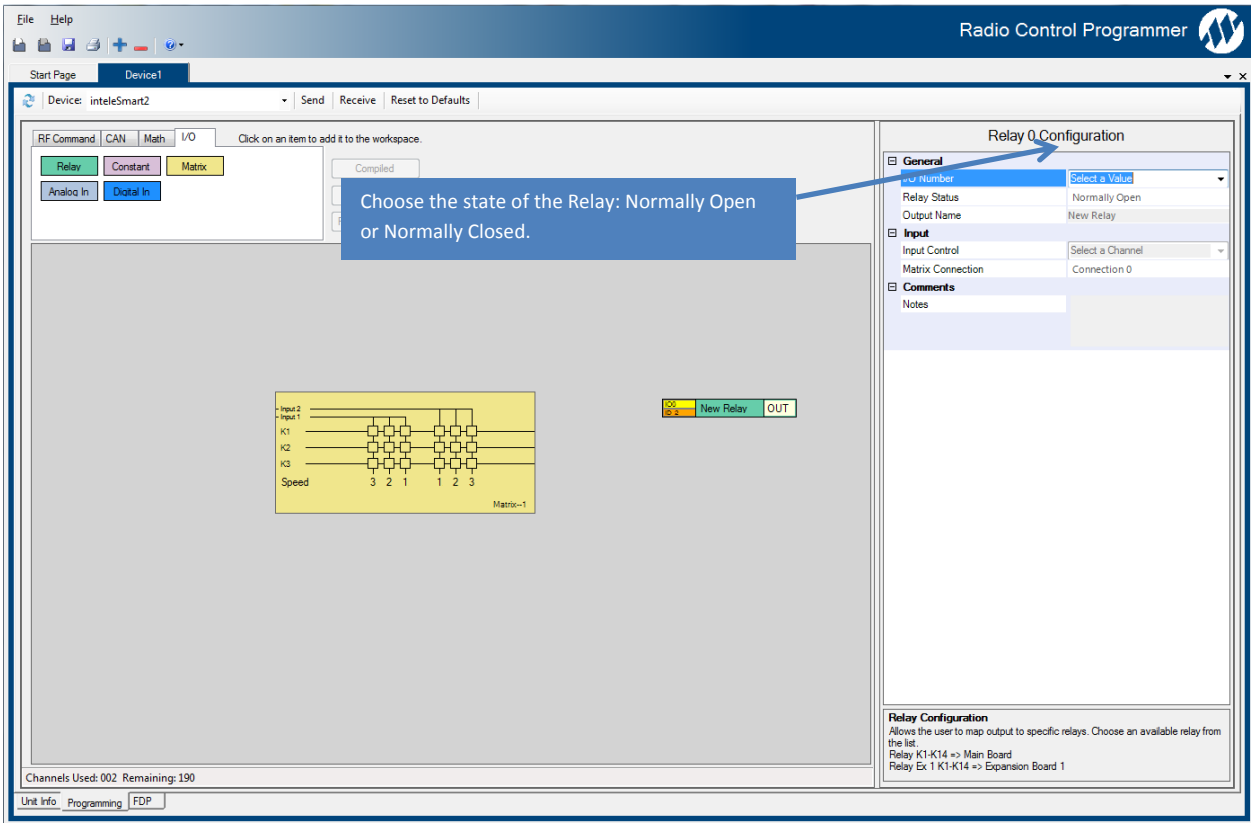

File Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Relay
Constant
Analog In
Digital In
Number of Speeds: Controls the number of columns displayed.
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
Matrix
General
Description
Configuration
Number of Speeds
3 Speed
Number of Relays
3
Input
Single Channel per Direction
Direction 1
Speed 1 Input
Select a Channel
Speed 2 Input
Speed 3 Input
Speed 4 Input
Speed 5 Input
Speed 6 Input
Direction 2
Custom Layout
Relay Labels
K1,K2,K3,
Input 1 Label
Input 1
Number of Relays: Controls the number of rows displayed.
Matrix Configuration
This channel allows the user to configure relays using a matrix view.
Channels Used: 001 Remaining: 191 2222 3333 4444
Unit Info
Programming
FDP

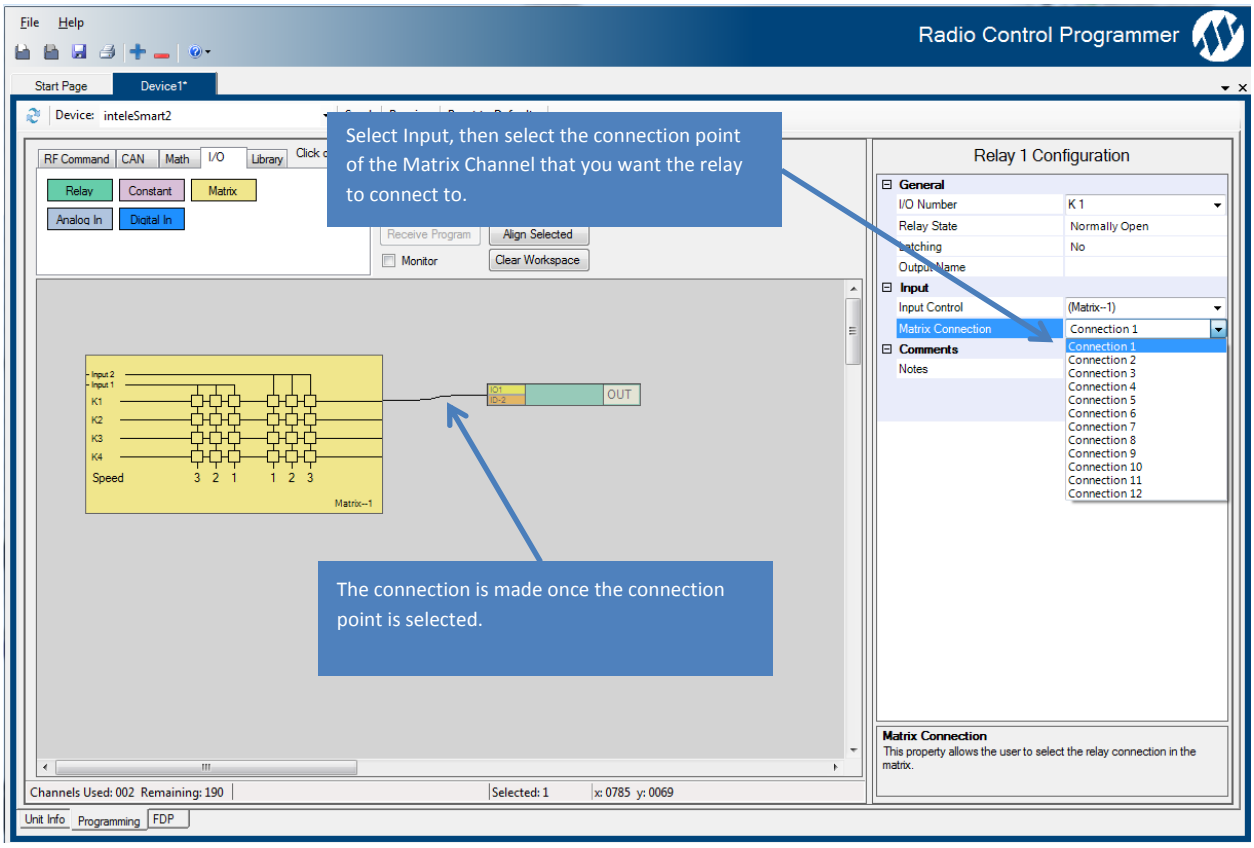

File Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
Relay
Constant
Matrix
Analog In
Digital In
Input Mode: Controls how the relays are driven.
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
The Input mode property controls the number of Speed Input properties available to edit.
Matrix
General
Description
Configuration
Number of Speeds
3 Speed
Number of Relays
3
Input Mode
Single Channel per Direction
Direction 1
Speed 1 Input
Select a Channel
Speed 2 Input
Speed 3 Input
Speed 4 Input
Speed 5 Input
Speed 6 Input
Direction 2
Custom Layout
Relay Labels
K1,K2,K3,
Matrix Configuration
This channel allows the user to configure relays using a matrix view.
Channels Used: 001 Remaining: 191 2222 3333 4444
Unit Info
Programming
FDP

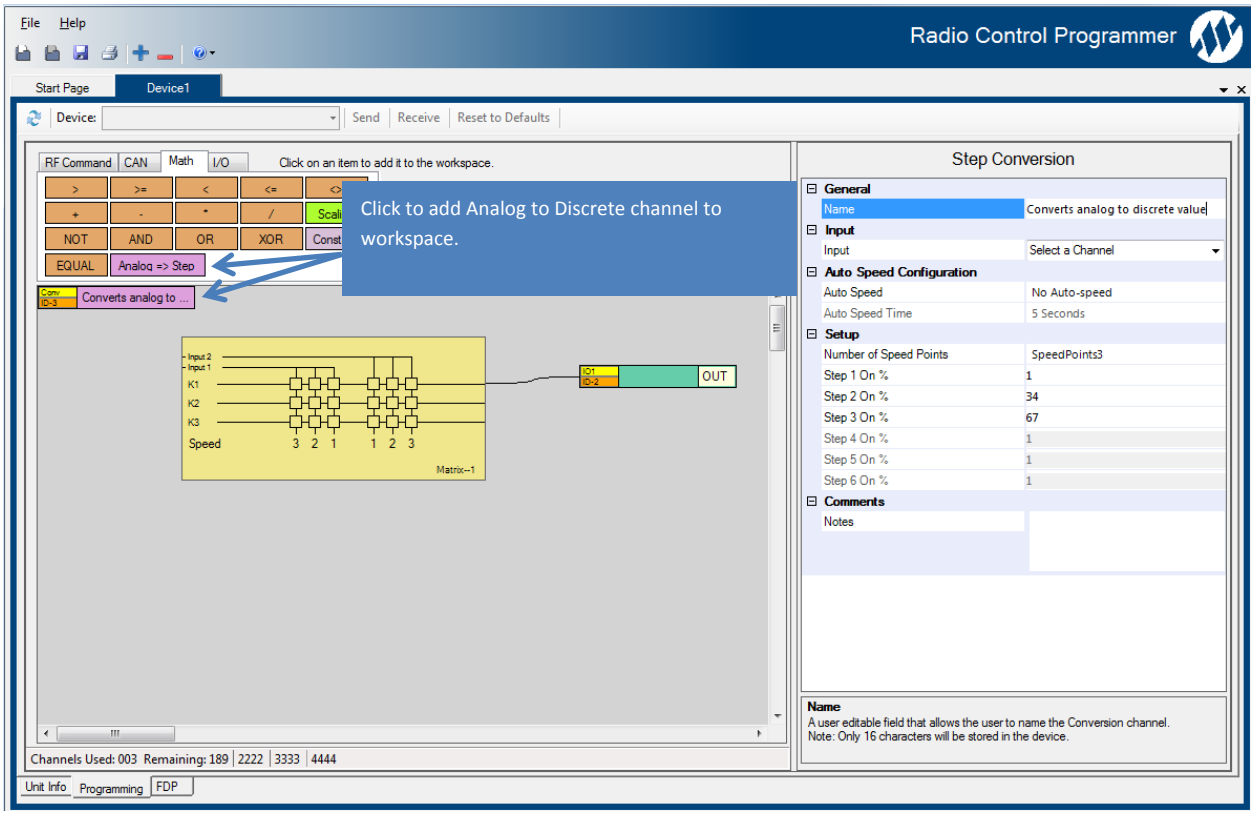

File Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
Relay
Constant
Matrix
Analog In
Digital In
Compiled
Input Label properties allow the user to change the text corresponding with the inputs.
Relay Labels property allows the user to change the text on the channel.
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
Matrix
Direction 1
Speed 1 Input
Speed 2 Input
Speed 3 Input
Speed 4 Input
Speed 5 Input
Speed 6 Input
Select a Channel
Direction 2
Custom Layout
Relay Labels
K1,K2,K3,
Input 1 Label
Input 1
Input 2 Label
Input 2
Comments
Notes
Matrix Configuration
This channel allows the user to configure relays using a matrix view.
Channels Used: 001 Remaining: 191 2222 3333 4444
Unit Info
Programming
FDP

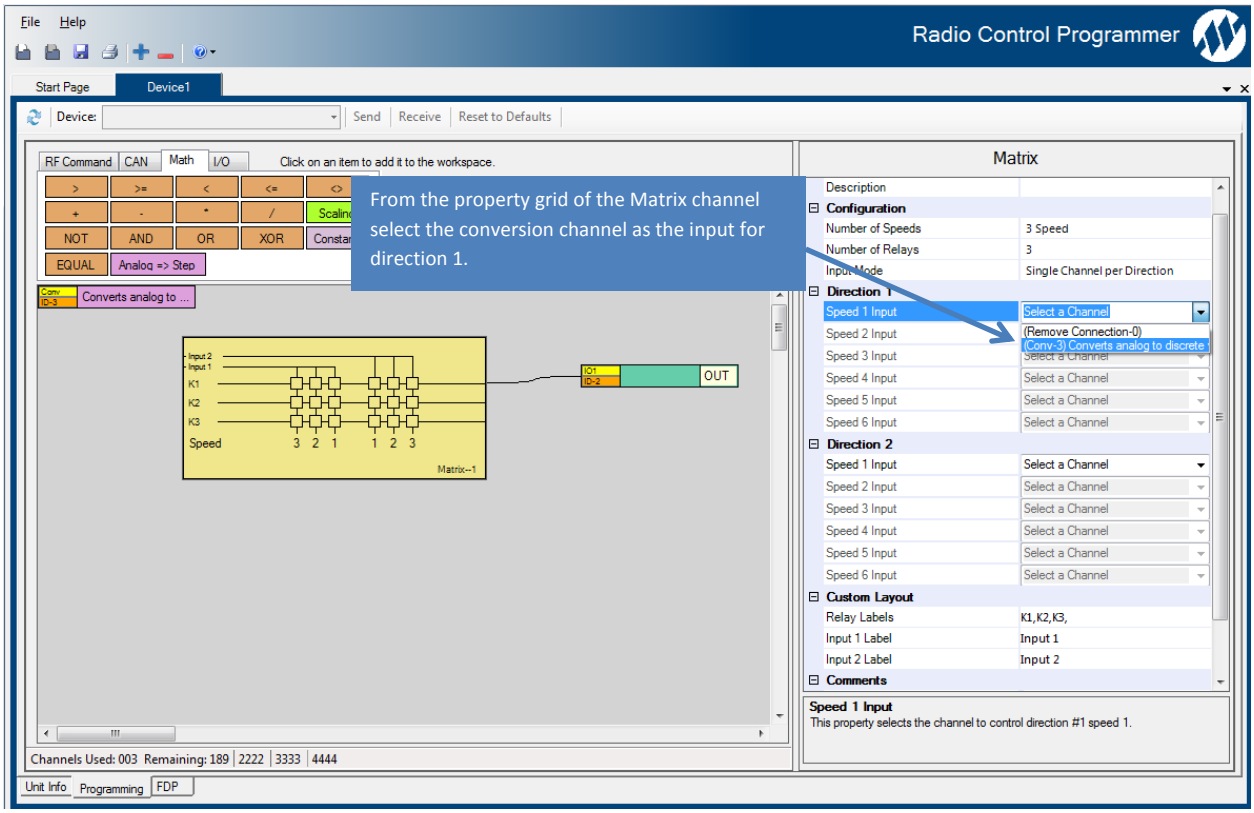

File Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
Relay
Constant
Matrix
Analog In
Digital In
Click Relay to add a Relay Channel to the workspace.
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
IO0
ID-2
New Relay
OUT
Relay 0 Configuration
General
I/O Number
Select a Channel
Output Name
New Relay
Input
Input Control
Select a Channel
Matrix Connection
Connection 0
Comments
Notes
Relay Configuration
Allows the user to map output to specific relays. Choose an available relay from the list.
Relay K1-K14 => Main Board
Channels Used: 002 Remaining: 190 2222 3333 4444
Unit Info
Programming
FDP

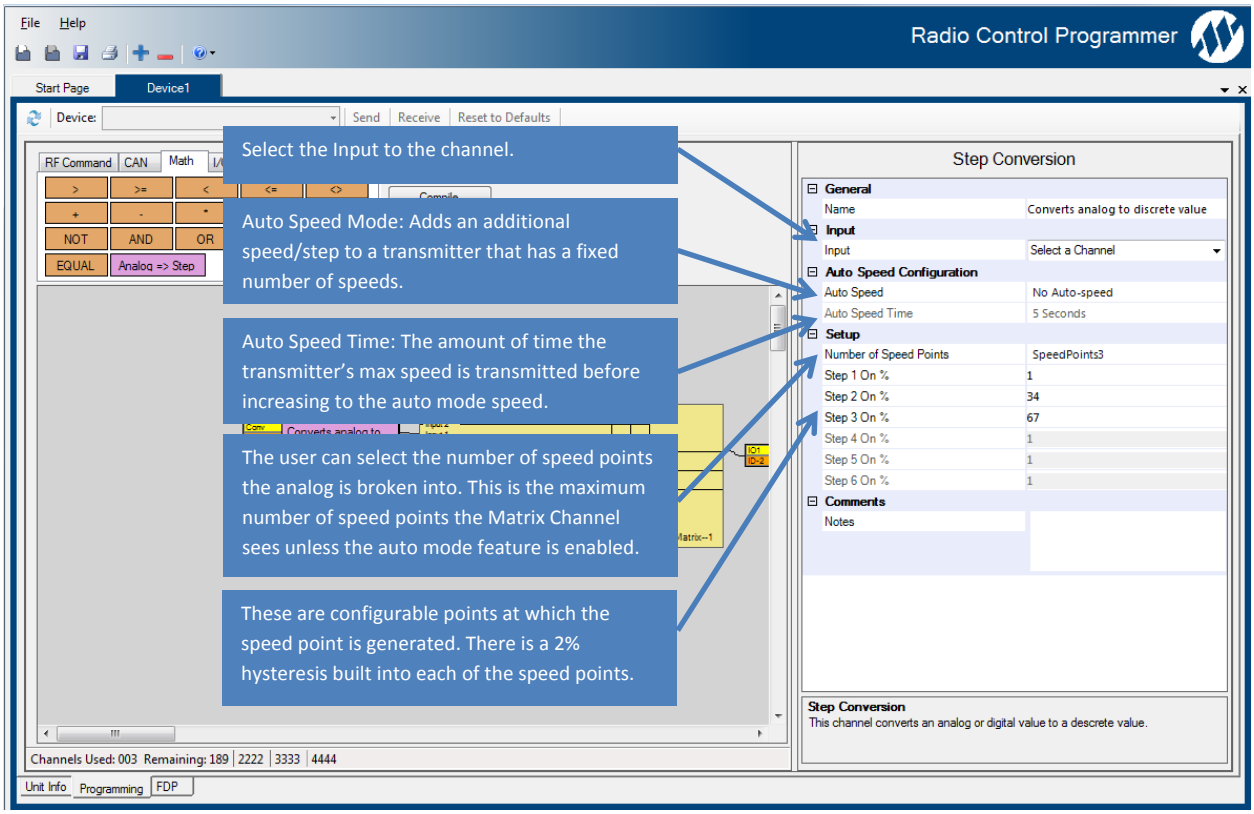

File Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Relay
Constant
Matrix
Analog In
Digital In
Receive Program
Clear Workspace
Select a relay to map the channel to. This list is comprised of main board.
Relay 0 Configuration
General
I/O Number
Output Name
Input
Input Control
Matrix Connection
Comments
Notes
Select a Channel
Select a Value
K 1
K 2
K 3
K 4
K 5
K 6
K 7
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
New Relay
OUT
I/O Number
This property selects the I/O to set this channel to. The grid will be updated with the settngs for that I/O.
The type of I/O depends on the type of device that is being configured.
Channels Used: 002 Remaining: 190 | 2222 | 3333 | 4444
Unit Info
Programming
FDP

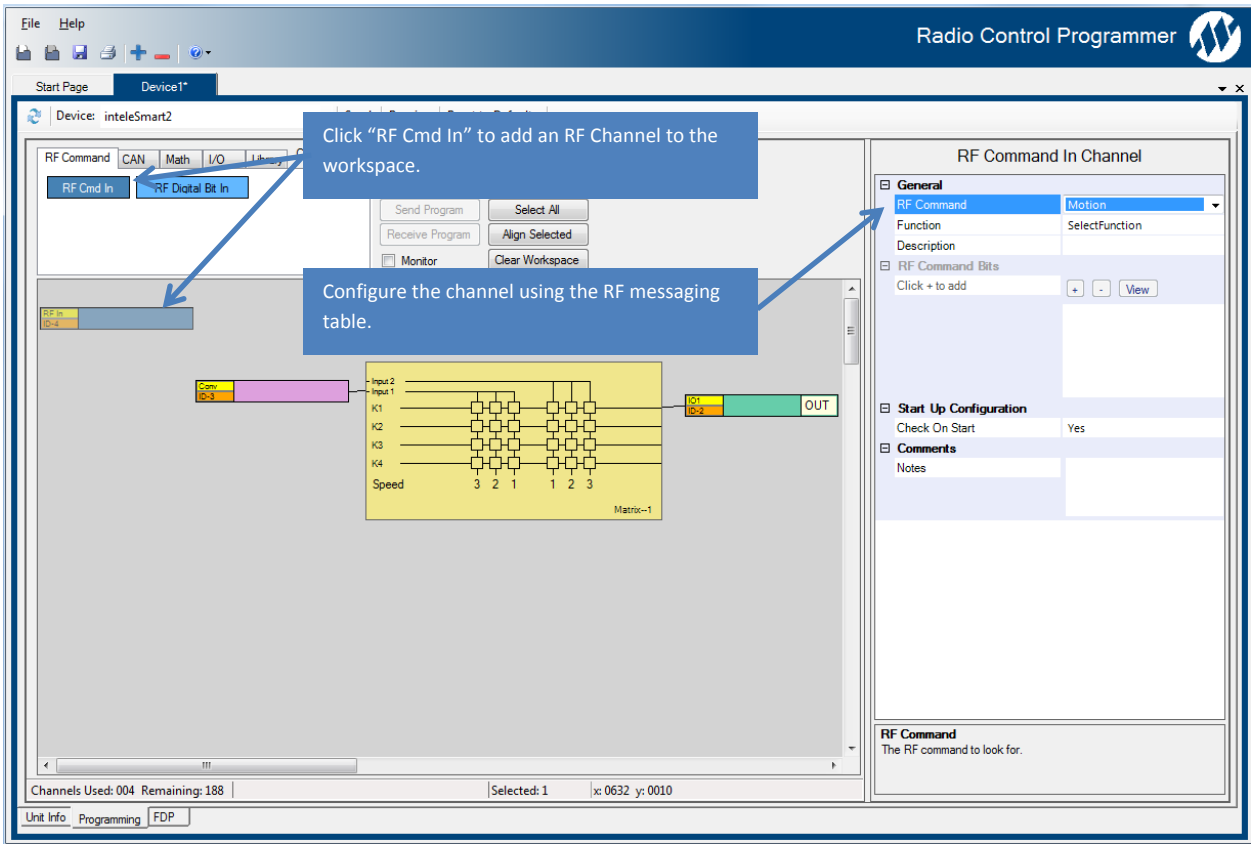

File Help
Radio Control Programmer
Start Page
Device1
Device: inteleSmart2
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
Relay
Constant
Matrix
Analog In
Digital In
Compiled
Choose the state of the Relay: Normally Open or Normally Closed.
Relay 0 Configuration
General
I/O Number
Select a Value
Relay Status
Normally Open
Output Name
New Relay
Input
Input Control
Select a Channel
Matrix Connection
Connection 0
Comments
Notes
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
New Relay
OUT
Relay Configuration
Allows the user to map output to specific relays. Choose an available relay from the list.
Relay K1-K14 => Main Board
Relay Ex 1 K1-K14 => Expansion Board 1
Channels Used: 002 Remaining: 190
Unit Info
Programming
FDP

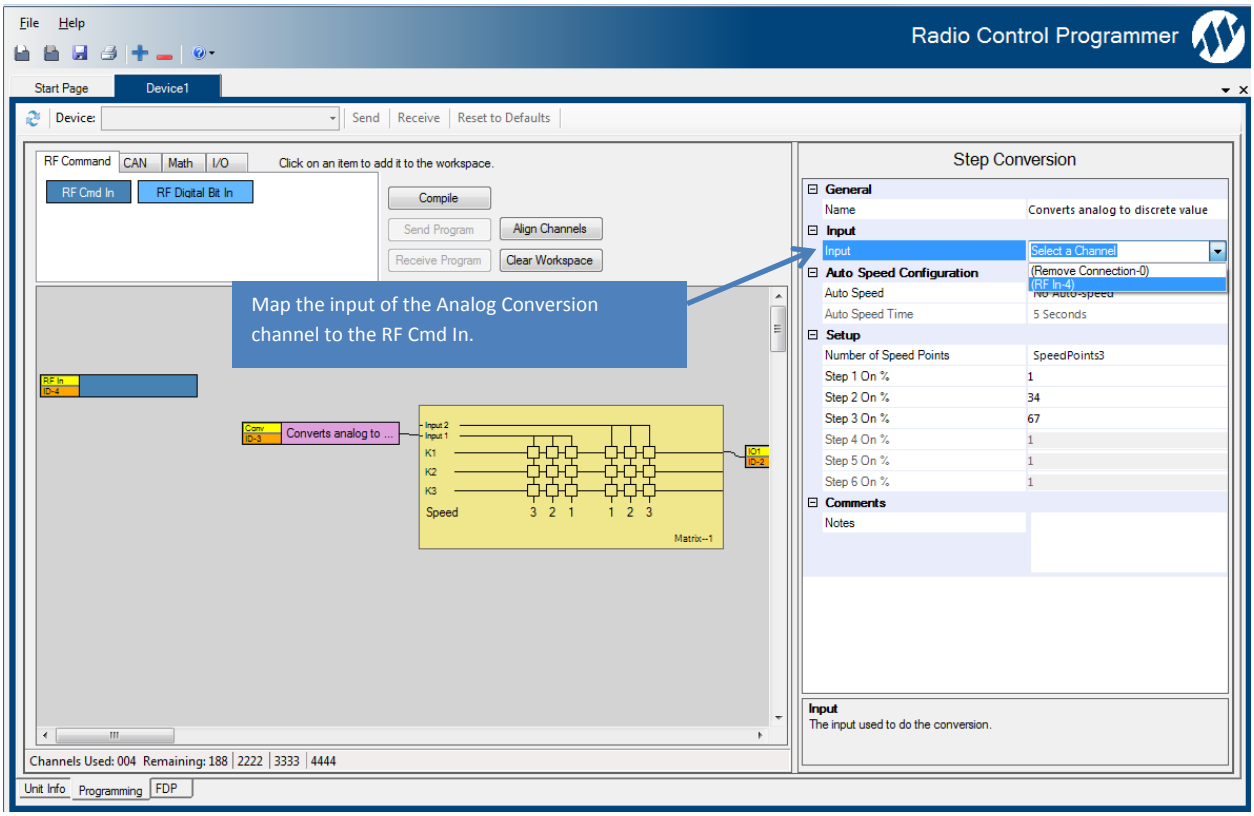

File Help
Radio Control Programmer
Start Page
Device1*
Device: inteleSmart2
Select Input, then select the connection point of the Matrix Channel that you want the relay to connect to.
RF Command
CAN
Math
I/O
Library
Relay
Constant
Matrix
Analog In
Digital In
Receive Program
Align Selected
Monitor
Clear Workspace
Input 2
Input 1
K1
K2
K3
K4
Speed
3 2 1 1 2 3
Matrix--1
OUT
The connection is made once the connection point is selected.
Relay 1 Configuration
General
I/O Number
K 1
Relay State
Normally Open
Latching
No
Output Name
Input
Input Control
(Matrix--1)
Matrix Connection
Connection 1
Comments
Notes
Connection 1
Connection 2
Connection 3
Connection 4
Connection 5
Connection 6
Connection 7
Connection 8
Connection 9
Connection 10
Connection 11
Connection 12
Matrix Connection
This property allows the user to select the relay connection in the matrix.
Channels Used: 002 Remaining: 190
Selected: 1
x: 0785 y: 0069
Unit Info
Programming
FDP


File Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
NOT
AND
OR
XOR
EQUAL
Analog => Step
Converts analog to ...
Click to add Analog to Discrete channel to workspace.
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
OUT
Step Conversion
General
Name
Converts analog to discrete value
Input
Select a Channel
Auto Speed Configuration
Auto Speed
No Auto-speed
Auto Speed Time
5 Seconds
Setup
Number of Speed Points
SpeedPoints3
Step 1 On %
1
Step 2 On %
34
Step 3 On %
67
Step 4 On %
1
Step 5 On %
1
Step 6 On %
1
Comments
Notes
Name
A user editable field that allows the user to name the Conversion channel.
Note: Only 16 characters will be stored in the device.
Channels Used: 003 Remaining: 189 2222 3333 4444
Unit Info
Programming
FDP


File Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
NOT
AND
OR
XOR
EQUAL
Analog => Step
Converts analog to ...
From the property grid of the Matrix channel select the conversion channel as the input for direction 1.
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
OUT
Matrix
Description
Configuration
Number of Speeds
3 Speed
Number of Relays
3
Input Mode
Single Channel per Direction
Direction 1
Speed 1 Input
Select a Channel
(Remove Connection-0)
(Conv-3) Converts analog to discrete
Speed 2 Input
Speed 3 Input
Speed 4 Input
Speed 5 Input
Speed 6 Input
Direction 2
Speed 1 Input
Speed 2 Input
Speed 3 Input
Speed 4 Input
Speed 5 Input
Speed 6 Input
Custom Layout
Relay Labels
K1,K2,K3,
Input 1 Label
Input 1
Input 2 Label
Input 2
Comments
Speed 1 Input
This property selects the channel to control direction #1 speed 1.
Channels Used: 003 Remaining: 189 2222 3333 4444
Unit Info
Programming
FDP


File Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
NOT
AND
OR
EQUAL
Analog => Step
Select the Input to the channel.
Auto Speed Mode: Adds an additional speed/step to a transmitter that has a fixed number of speeds.
Auto Speed Time: The amount of time the transmitter's max speed is transmitted before increasing to the auto mode speed.
The user can select the number of speed points the analog is broken into. This is the maximum number of speed points the Matrix Channel sees unless the auto mode feature is enabled.
These are configurable points at which the speed point is generated. There is a 2% hysteresis built into each of the speed points.
Step Conversion
General
Name
Converts analog to discrete value
Input
Input
Select a Channel
Auto Speed Configuration
Auto Speed
No Auto-speed
Auto Speed Time
5 Seconds
Setup
Number of Speed Points
SpeedPoints3
Step 1 On %
1
Step 2 On %
34
Step 3 On %
67
Step 4 On %
1
Step 5 On %
1
Step 6 On %
1
Comments
Notes
Step Conversion
This channel converts an analog or digital value to a descrete value.
Channels Used: 003 Remaining: 189
Unit Info
Programming
FDP

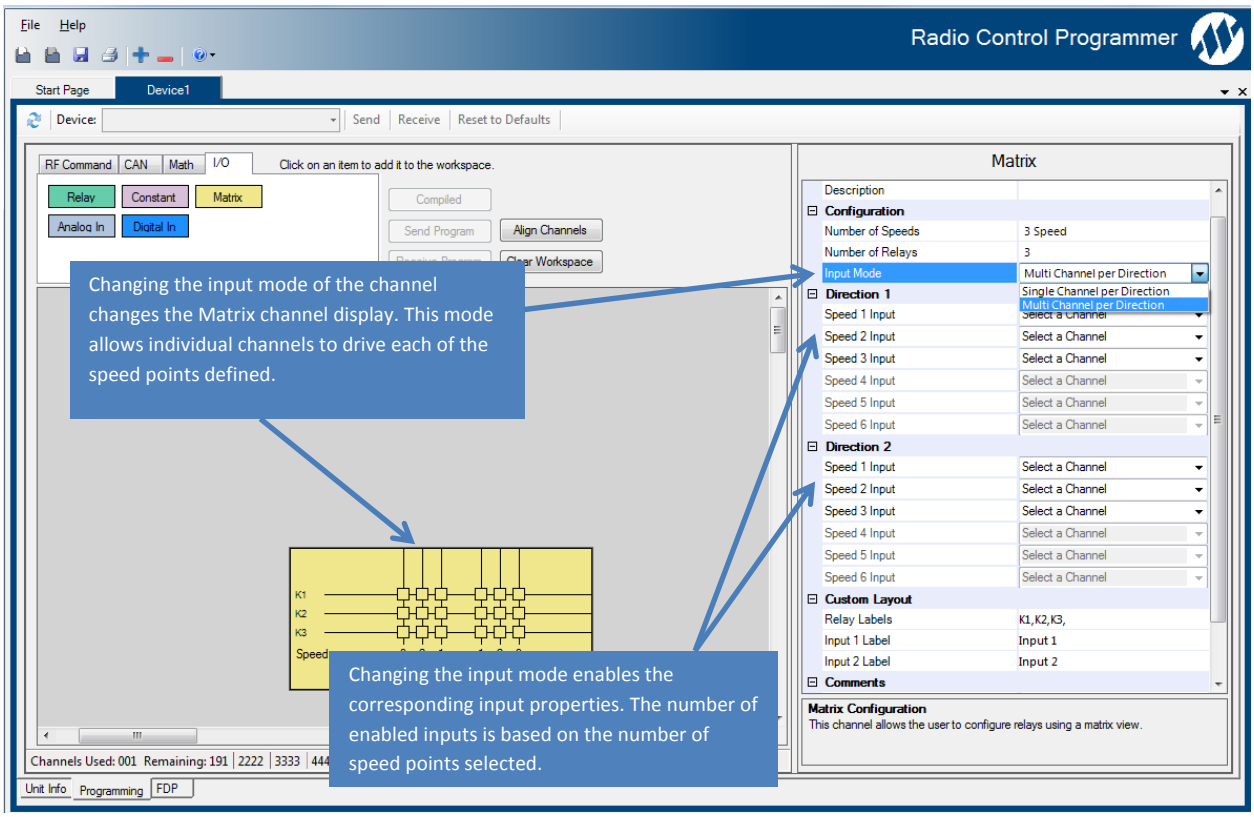

File Help
Radio Control Programmer
Start Page
Device1*
Device: inteleSmart2
RF Command
CAN
Math
I/O
RF Cmd In
RF Digital Bit In
Click "RF Cmd In" to add an RF Channel to the workspace.
Send Program
Select All
Receive Program
Align Selected
Monitor
Clear Workspace
Configure the channel using the RF messaging table.
Input 2
Input 1
K1
K2
K3
K4
Speed
3 2 1
1 2 3
OUT
Matrix--1
RF Command In Channel
General
RF Command
Motion
Function
SelectFunction
Description
RF Command Bits
Click + to add
View
Start Up Configuration
Check On Start
Yes
Comments
Notes
RF Command
The RF command to look for.
Channels Used: 004 Remaining: 188
Selected: 1
x: 0632 y: 0010
Unit Info
Programming
FDP

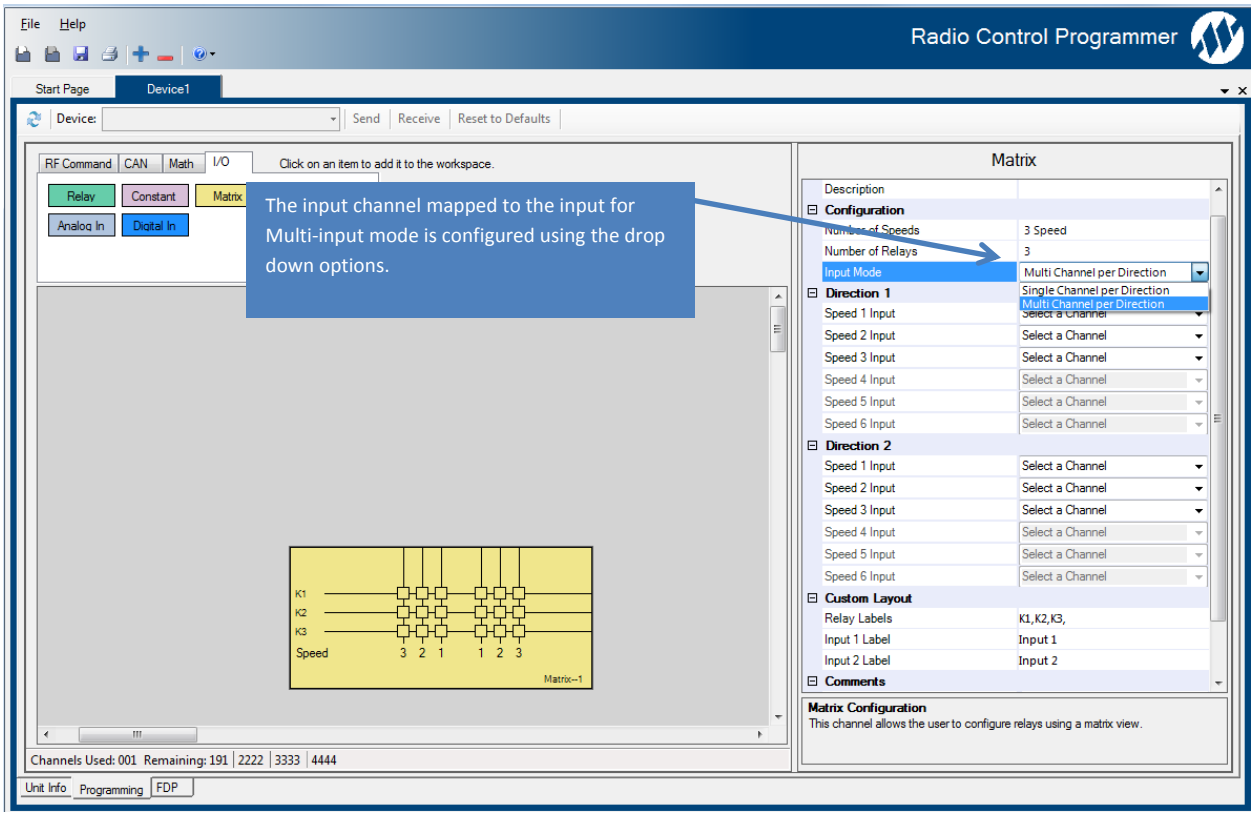

File
Help
Radio Control Programmer
Start Page
Device1
Device:
Send
Receive
Reset to Defaults
RF Command
CAN
Math
I/O
Click on an item to add it to the workspace.
RF Cmd In
RF Digital Bit In
Compile
Send Program
Align Channels
Receive Program
Clear Workspace
Map the input of the Analog Conversion channel to the RF Cmd In.
RF In
ID-4
Conv
ID-3
Converts analog to ...
Input 2
Input 1
K1
K2
K3
Speed
3 2 1 1 2 3
Matrix--1
IO1
ID-2
Channels Used: 004 Remaining: 188 | 2222 | 3333 | 4444
Unit Info
Programming
FDP
Step Conversion
General
Name
Converts analog to discrete value
Input
Input
Select a Channel
(Remove Connection-0)
(RF In-4)
Auto Speed Configuration
Auto Speed
Auto Speed Time
5 Seconds
Setup
Number of Speed Points
SpeedPoints3
Step 1 On %
1
Step 2 On %
34
Step 3 On %
67
Step 4 On %
1
Step 5 On %
1
Step 6 On %
1
Comments
Notes
Input
The input used to do the conversion.

7.3.4 Multi Input Mode using the Matrix Channel

This section will show how to use the Matrix Channel in Multi-Input Mode

Start by creating a new project with an in*tele*Smart2 device selected and allow the device configuration to be read. This is the same process explained in Section 5. Once the project is started, navigate to the Programming Tab across the bottom of the UI. From the I/O tab add a Matrix channel the workspace.





NOTE: Any values greater than zero will cause the relays mapped to the input to be driven high.

7.3.5 CAN-2 Mapping

The CAN-2 device is configured the same as the MHR and in*tele*Smart2 devices. The CAN-2 also requires special firmware to support the mapping capability of RCP.

7.3.6 Additional Mapping Examples

This section shows some commonly used mappings. Refer to Section 7 for specifics on each of the various types of connections.

Figure 34: Example of a digital input being mapped directly to an output.

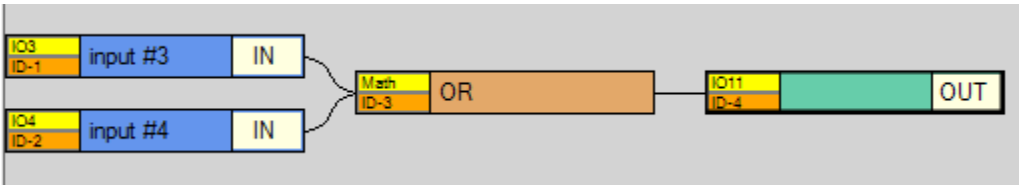


Figure 35: Example of a mathematical operation performed on inputs before directing to an output.

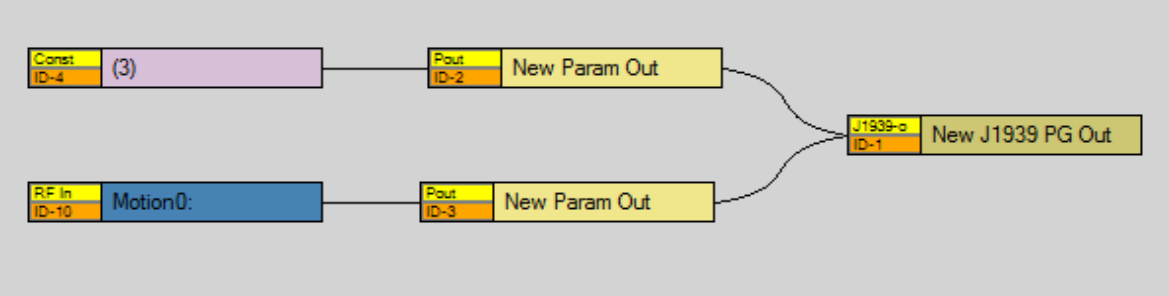


Figure 36: Example of a J1939 Parameter Group message being constructed using a Constant and an RF Motion Command.

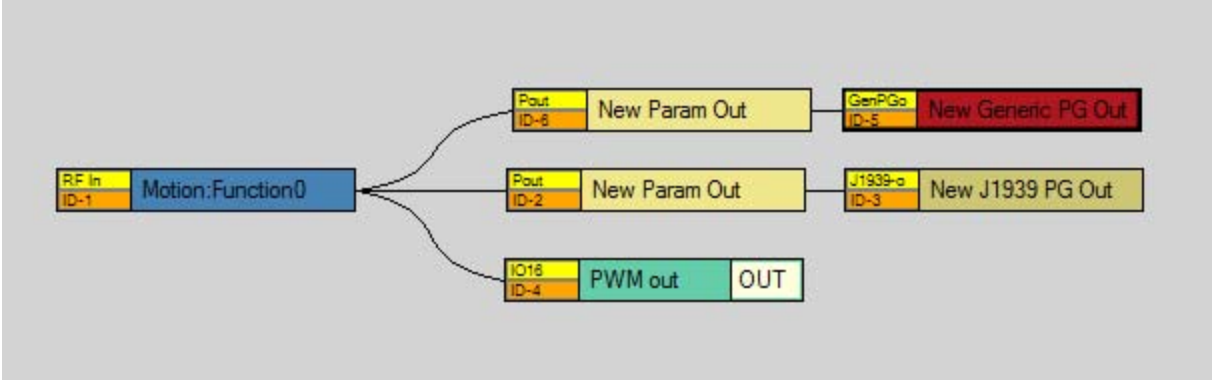


Figure 37: This example shows how the data from the RF command can be distributed through several channels.

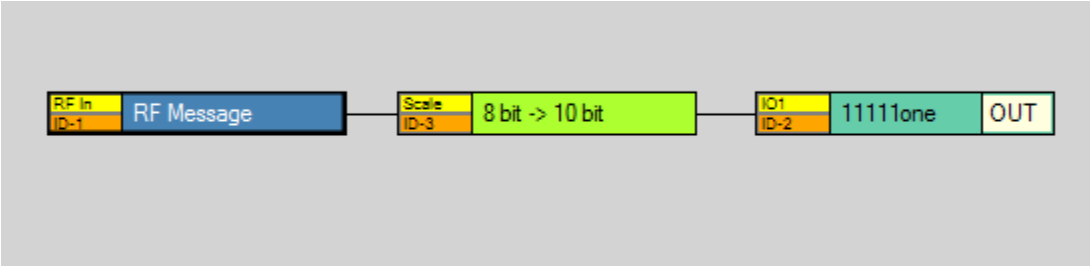


Figure 38: This example shows how to scale an 8-bit RF message to a 10-bit value to drive an output. *NOTE: This is needed to achieve full scale on the output.*

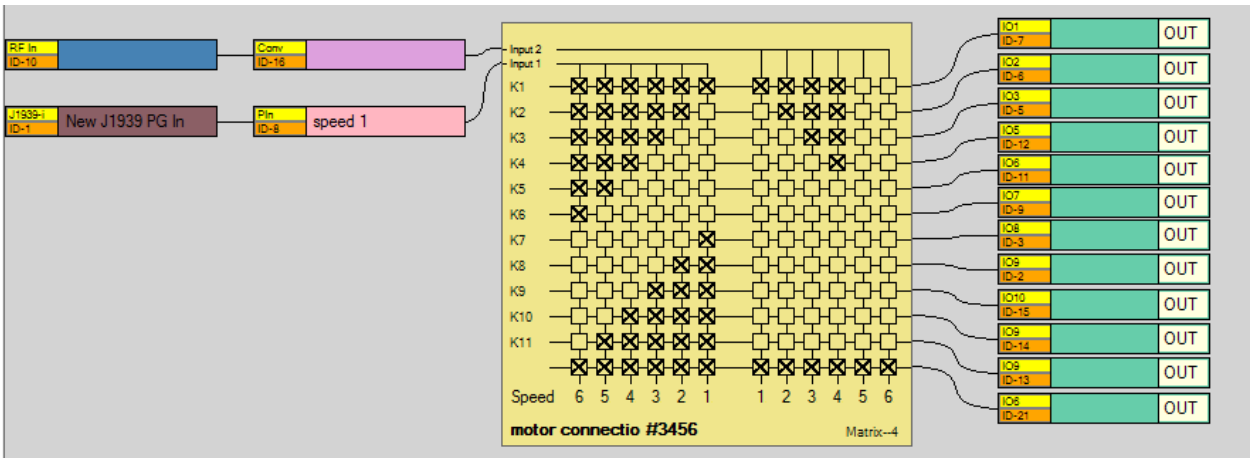


Figure 39: This example shows how to configure 12 relays using various input methods to drive the relays.

7.3.7 RF Masking

The CAN-2, MHR and in*tele*Smart2 receivers support RF masking. This feature allows the receiver to come online even if the RF command is active. This property is available on either RFCmd or RFDigBit channels.

Only the XLTX/MLTX2/MBT/PGT transmitters send the data during the start sequence.

Figure 40: The channels that support Check On Start

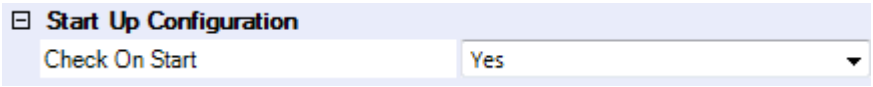


Figure 41: Property to check or ignore during start sequence.

8 Channel and Frequencies

Table 13: Channel Sets and Frequencies

400 MHz Part 15	
Channel	Frequency
01	433.000 MHz
02	433.050 MHz
03	433.100 MHz
04	433.150 MHz
05	433.200 MHz
06	433.250 MHz
07	433.300 MHz
08	433.350 MHz
09	433.400 MHz
10	433.450 MHz
11	433.500 MHz
12	433.550 MHz
13	433.600 MHz
14	433.650 MHz
15	433.700 MHz
16	433.750 MHz
17	433.800 MHz
18	433.850 MHz
19	433.900 MHz
20	433.950 MHz
21	434.000 MHz
22	434.050 MHz
23	434.100 MHz
24	434.150 MHz
25	434.200 MHz
26	434.250 MHz
27	434.300 MHz
28	434.350 MHz
29	434.400 MHz
30	434.450 MHz
31	434.500 MHz
32	434.550 MHz

419 MHz	
Channel	Frequency
01	410.300 MHz
02	410.300 MHz
03	419.200 MHz
04	419.300 MHz
05	419.300 MHz
06	419.300 MHz
07	419.800 MHz
08	419.300 MHz
09	419.300 MHz
10	419.100 MHz
11	419.300 MHz
12	419.100 MHz
13	419.500 MHz
14	419.700 MHz
15	419.600 MHz
16	419.700 MHz
17	419.900 MHz
18	419.100 MHz
19	419.100 MHz
20	419.700 MHz
21	419.000 MHz
22	419.200 MHz
23	419.000 MHz
24	419.200 MHz
25	419.400 MHz
26	419.600 MHz
27	419.800 MHz
28	419.800 MHz
29	419.400 MHz
30	419.200 MHz
31	419.300 MHz
32	419.300 MHz

900 MHz Part15	
Channel	Frequency
01	903.30 MHz
02	906.30 MHz
03	907.80 MHz
04	909.30 MHz
05	912.30 MHz
06	915.30 MHz
07	919.80 MHz
08	921.30 MHz
09	902.30 MHz
10	904.10 MHz
11	904.30 MHz
12	905.10 MHz
13	905.50 MHz
14	905.70 MHz
15	906.60 MHz
16	908.70 MHz
17	908.90 MHz
18	909.10 MHz
19	910.10 MHz
20	910.70 MHz
21	911.00 MHz
22	911.20 MHz
23	912.00 MHz
24	914.20 MHz
25	914.40 MHz
26	914.60 MHz
27	914.80 MHz
28	915.80 MHz
29	917.40 MHz
30	923.20 MHz
31	927.00 MHz
32	927.30 MHz

2.4 GHZ: FHSS

Channel sets are designated between 1 and 32. The frequency range is between 2402-2478 MHz. The frequency hopping protocol does not use one particular frequency to transmit a message. Messages are transmitted over multiple frequencies in a predefined sequence or channel set. In doing so, this protocol is able to compensate for interference that may be present on a single frequency by sending the message across multiple frequencies.

Appendix A.

The CAN messages contain 8 bytes of data. The following table describes the data portion of the messages.

PGN 65410	Number of Bits
PGN 65410	8
Battery Level	8
RSSI	2
Command Data Valid	2
Horn Command	2
Stop Command	2
Start Command	16
Project ID	20
Transmission ID	4

PGN 65411	Number of Bits
Digital Bits 1-8 for Function 1	8
Digital Bits 1-8 for Function 2	8
Digital Bits 1-8 for Function 3	8
Digital Bits 1-8 for Function 4	8
Digital Bits 1-8 for Function 5	8
Digital Bits 1-8 for Function 6	8
Digital Bits 1-8 for Function 7	8
Digital Bits 1-8 for Function 8	8

PGN 65412	Number of Bits
Digital Bits 1-8 for Function 9	8
Digital Bits 1-8 for Function 10	8
Digital Bits 1-8 for Function 11	8
Digital Bits 1-8 for Function 12	8
Digital Bits 1-8 for Function 13	8
Digital Bits 1-8 for Function 14	8
Digital Bits 1-8 for Function 15	8
Digital Bits 1-8 for Function 16	8

Data values for Motion and Analog data are clip at 250 for J1939 compliance.

PGN 65413	Number of Bits
Motion Command Data 1	8
Motion Command Data 2	8
Motion Command Data 3	8
Motion Command Data 4	8
Motion Command Data 5	8
Motion Command Data 6	8
Motion Command Data 7	8
Motion Command Data 8	8

PGN 65414	Number of Bits
Motion Command Data 9	8
Motion Command Data 10	8
Motion Command Data 11	8
Motion Command Data 12	8
Motion Command Data 13	8
Motion Command Data 14	8
Motion Command Data 15	8
Motion Command Data 16	8

PGN 65415	Number of Bits
Analog Command Data 1	8
Analog Command Data 2	8
Analog Command Data 3	8
Analog Command Data 4	8
Analog Command Data 5	8
Analog Command Data 6	8
Analog Command Data 7	8
Analog Command Data 8	8

PGN 65416	Number of Bits
Analog Command Data 9	8
Analog Command Data 10	8
Analog Command Data 11	8
Analog Command Data 12	8
Analog Command Data 13	8
Analog Command Data 14	8
Analog Command Data 15	8
Analog Command Data 16	8