ScadaFlex I/O Toolbox
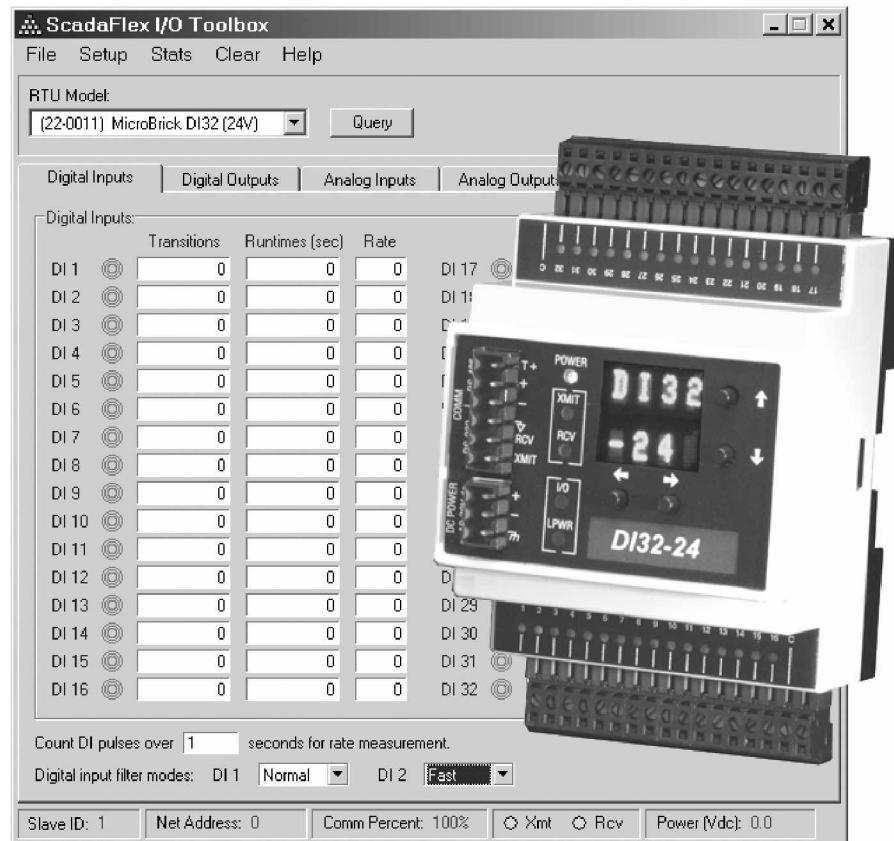
for ScadaFlex RTUs, MicroBricks & PicoBricks

- Universal configuration tool for all ScadaFlex I/O
- Examine and set all configuration registers
- Supports both local and "over the link" configuration
- Access all data collection/totalizer registers
- Includes Analog Input/Output "closed case" calibration tools
- Supports I/O module "closed case" Flash memory firmware updates
- Built-in terminal emulation for internal radio/modem setup
- Automatic model ID and communications setup feature
- Save and restore configurations for backup and cloning
- Full performance statistics for communications link verification
- Runs on any Windows platform from Windows 95 to Windows XP

ScadaFlex I/O Toolbox
Technical Reference Manual

Acknowledgments

ScadaFlex, ScadaFlex Plus, ScadaFlex Viewpoint, ScadaWorks, ScadaBuilder, MicroBrick and PicoBrick are trademarks of Industrial Control Links, Inc.

In This Manual . . .

This manual provides the information required to use the ScadaFlex I/O Toolbox software to exercise and configure ICL ScadaFlex RTUs, and PicoBrick and MicroBrick distributed I/O modules.

If you have just purchased the ScadaFlex I/O Toolbox software, we hope that you are pleased with it and the I/O modules that it supports.

If you are reading this manual looking at a future purchase, we hope that you will consider using the ScadaFlex I/O modules when you have an application that needs compact, reliable distributed or remote I/O.

Support

If you have questions or need help with an application, we hope that you'll take advantage of our free technical support. Simply call us at:

(800) 888-1893

If you need to send us a fax, use either:

(530) 888-1300 or (530) 888-7017

You may also send us e-mail at:

icl@www.iclinks.com

For additional technical information including datasheets, manuals and software, visit our web site at:

www.iclinks.com

Contents

About the ScadaFlex I/O Toolbox

The ScadaFlex I/O Toolbox is a Windows based application for exercising, configuring and maintaining ICLs ScadaFlex family of RTUs and distributed I/O modules including PicoBricks, MicroBricks and ScadaFlex RTUs.

Autoconfiguration
The ScadaFlex I/O Toolbox software can automatically identify the module that it's talking to, and "morph" the screens to the correct configuration for that module.

I/O, Data Collection and Configuration Register Access
The ScadaFlex I/O Toolbox software provides real-time access to the attached modules analog and discrete I/O points as well as all data collection and configuration registers.

Configuration Backup and Cloning
With the ScadaFlex I/O Toolbox software, it's fast and easy to save away backup copies of any modules configuration, and reload the configuration at a later date. This feature can also be used for configuration "cloning".

"Over the Link" Remote Access
Access to all module I/O points, data collection registers and configuration information is available over the communications link, saving time and frequently eliminating the need to physically visit remote sites.

Calibration Support
The ScadaFlex I/O toolbox provides access to tools required to periodically verify and, if needed, make adjustments to the calibration of analog inputs and outputs.

ScadaFlex RTU Internal Modem and Radio Setup Support
The ScadaFlex I/O Toolbox software has a built-in access software for configuring the optional internal modems and radios in ScadaFlex RTUs.

Firmware Updates
If features or enhancements are made to the internal I/O module programs, the modules can be updated in the field in less than a minute using the toolbox softwares I/O module flash memory update feature.

Getting Started

The ScadaFlex I/O Toolbox comes on a CDROM, typically as part of the ScadaFlex I/O "Starter Kit". The Starter Kit also includes a set of cables for connecting a PC computer to the RS-232 port of any one of the ScadaFlex family of RTUs and distributed I/O modules. The Toolbox software may also be connected to a wireless or hardwired network of ScadaFlex I/O modules.

Installation

The ScadaFlex I/O Toolbox software is installed in the same manner as any other Windows program. The installer will start automatically if your computer is configured to "Autorun" programs on CDs, or may be started manually be double-clicking on the Installer Icon when viewed by the Windows Explorer program. Follow the instructions prompted by the installer.

Main Screen

When started, the program will display the "Main Screen" with up to four tabs for the I/O screens (one for each I/O type), a set of menu selections along the top of the screen, and a status bar along the bottom of the screen.
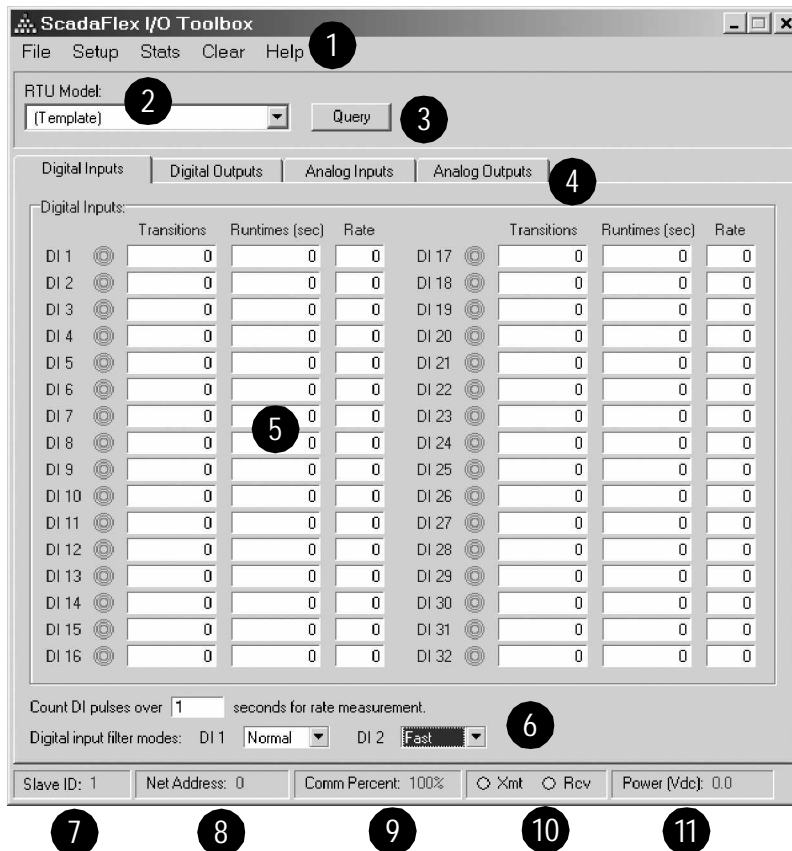
1 Program Menus
Menus for access to configuration, calibration and module collected data.

2 Module Model#
A selection window that, when the program is communicating with a module, displays the modules model number and name ("template" shows the maximum possible I/O configuration, not specific to any I/O module). This window may also be used to manually select a module.

3 Force Module Query
Forces the program to query the module to identify itself. Use this button when you change I/O modules.

4 I/O Screen Tabs
Use these tabs to select one of four I/O screens; Discrete Inputs, Discrete Outputs, Analog Inputs, and Analog Outputs.

5 I/O Data
One to four screens, one for each I/O type: Discrete Inputs, Discrete Outputs, Analog Inputs, and Analog Outputs, with varying numbers of I/O points depending on the module that the program is communicating with.

6 I/O Specific Configuration
Many modules have specific parameters that may be viewed and set at the bottom of that I/O sections screen. These include DI filter controls and totalizer sample rates, DO flash rates, AI totalizer sampling period, etc.

7 Slave ID
This section shows the ID (address) of the current device that the toolbox is to communicate with. You can "click" on this box to change the current unit being addressed. If the Toolbox is NOT connected to a network, an ID of 255 may be used regardless of the modules address settings.

8 Network ID
When communicating with an I/O module using address 255, this box displays the actual network ID setting of the I/O module, including any base address offset, switches, etc. This value is read from the unit.

9 Comm. Percent
Provides an indication of the quality of the communications link with the ratio of messages transmitted to valid responses expressed as a percentage.

10 Transmit and Receive Status Indicators
These two "lights" show activity on the transmit and receive data lines just like LED status indicators.

11 Power (Vdc)
When "talking" with an I/O module, this window displays the input power (voltage) to the unit. The measurement resolution is 0.1Vdc.

Connecting Up
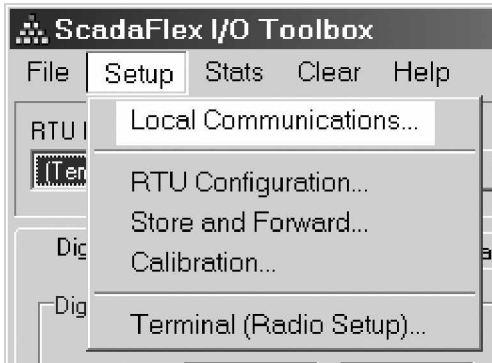
The "target" I/O module must be connected to the serial port of your PC computer and the Toolbox software must have several parameters set properly to communicate with a ScadaFlex I/O module.

To get to the local communications parameters, click on "Setup" on the upper menu bar, and then "Local Communications" in the menu that pops down.

Com Port

This setting must match the serial port on your PC connected to the I/O module. If you are not sure, start with "COM1".

Baud Rate

This setting must match the communications "baud rate" configuration in the I/O module. If you're not sure, set this value to "auto" and the Toolbox will figure it out for you.

Response Timeout

This setting determines the maximum time that the Toolbox will wait for a response to a message that it sends to an I/O module. On a direct connection, 1000mS (1 second) is more than adequate, but over a telephone or radio link, it may need to be set to several seconds.

Enable Auto Query

This box is checked when you want the Toolbox software, upon startup, to automatically determine the type of module that it is talking to and configure the various module specific screens appropriately. We recommend leaving this box checked.

Network Address

You can set the address of the I/O module that the Toolbox software will talk to by setting this value. If you are NOT on a network and are not sure of the address of the I/O module, use a value of 255 which is a "universal" address that all ScadaFlex I/O modules respond to regardless of their network address configuration.

8
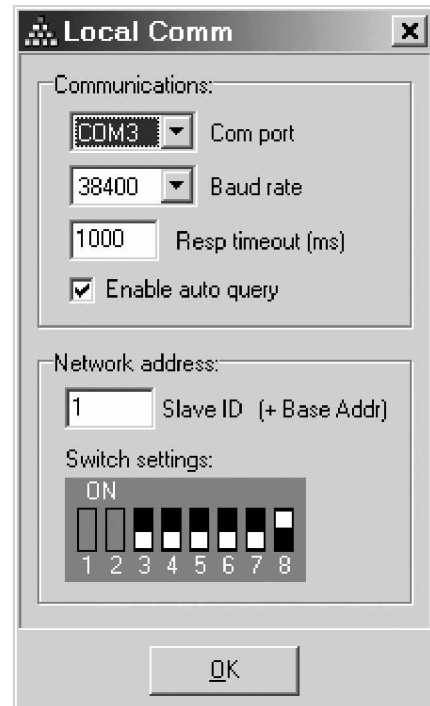
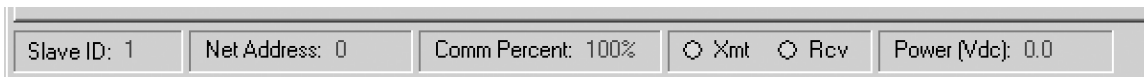When you are finished configuring the local communications settings, close the window by clicking on the "OK" button. This will bring you back to the Main Window.

Along the bottom of the Main Window is a status bar with information on the communications link:

Slave ID: 1	Net Address: 0	Comm Percent: 100%	○ Xmt ○ Rcv	Power (Vdc): 0.0

When the Toolbox software is connected and configured properly and talking to an I/O module, you will see that the "Xmt" and Rcv" indicators are both lit GREEN and the Comm Percent value should rise to about 100%.

If you are having trouble communicating . . .

If you are having trouble establishing communications, check the following:

Ü Do you have power ON to the I/O module?

Ü Is the cable plugged in between your PC and the I/O module?

Ü Is the cable the one that came with the starter kit from ICL? If you made your own, double check your wiring against the diagram in the I/O modules technical reference manual.

Ü Try a different Com Port setting. Some computers have a modem in "COM1" so the serial port may actually be "COM2"

Ü Try using a longer "Response Timeout" value. Some "high-speed" links that claim fast data rates can have a high baud rate capability, but still have a long "round trip" latency for messages.

Ü Try using a Slave ID of 255, even if you think that you know the address that the module is set to. Once you're talking to the module, the "Net Address" in the lower status bar will tell you what the actual address is.

Ü Try using the "Auto" setting for baud rate.

I/O Screens

The ScadaFlex I/O Toolbox may be used to display analog and discrete input levels, and provide a means of setting analog and discrete output levels. Each of the I/O types; Analog In, Discrete In, Analog Out, and Discrete Out have screens dedicated to their functions.

The following screens show a superset of all of the possible I/O points. For any given module, only a portion of these I/O points are actually supported and displayed. In fact, only a few modules support all four I/O types, so some entire screens may not be used for a given module.

Discrete Inputs

Depending on the model, ScadaFlex I/O modules can have up to thirty-two discrete input points, as depicted in the screen image below:

Copyright © 2003   Industrial Control Links, Inc. All Rights Reserved
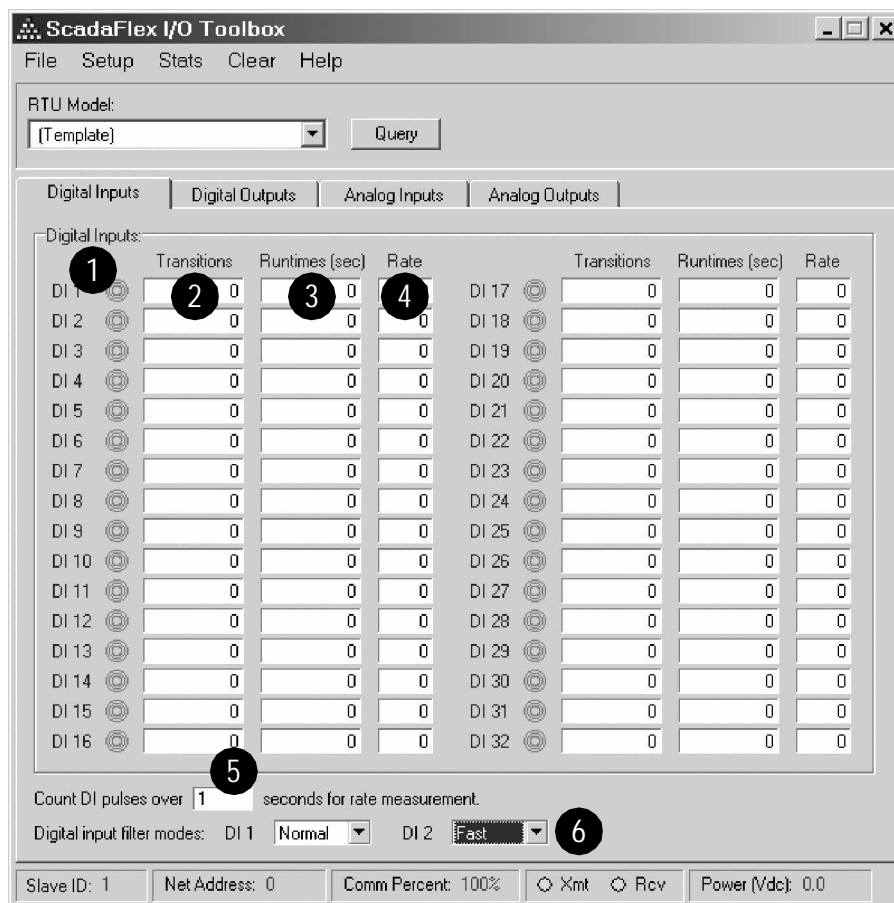
1 Input Status Indicators

The Discrete Inputs have individual status indicators that glow GREEN when the inputs are ON.

2 **4** Input Totalizers and Rate Registers

Some discrete input signals are trains of pulses representing flow or consumption. ScadaFlex RTUs can be configured to periodically "snap-shot" the number of transitions that occur within a user specified time period as well as accumulate the total number of transitions. The former provides an indication of flow rate or consumption, while the later represents a total flow or consumption figure for billing or custody transfer purposes. The totalizer registers are 32-bits wide, for a maximum value of 4,294,836,225. Beyond this value, the registers automatically "roll over" to zero and start counting up again. The rate registers are 16-bits wide, for a maximum count of 65,535.

3 Runtime Registers

ScadaFlex I/O modules accumulate the total time that every discrete input is ON. The runtime measurement resolution is one (1) second. The runtime registers are 32-bits wide, for a maximum value of 4,294,836,225 seconds (136 years).

5 Pulse Rate Sampling Time

The sampling time period for rate calculations is user configurable. The sampling period is set in 1 second increments. Longer sampling times provides better measurment resolutions at the expense of slower up-date rates.

6 Programmable Filters

Many of the ScadaFlex I/O Modules and RTUs have programmable filtering on a pair of discrete inputs. When the filtering is disabled (set to "fast"), the inputs count pulses at rates of up to 5KHz (5,000 pulses per second). When the filters are enabled, these channels respond like the other "normal" discrete inputs which have a maximum input rate of a little over 40Hz (40 pulses per second).

Discrete Outputs

Depending on the model, ScadaFlex I/O modules can have up to thirty-two discrete output points as depicted in the screen image below:
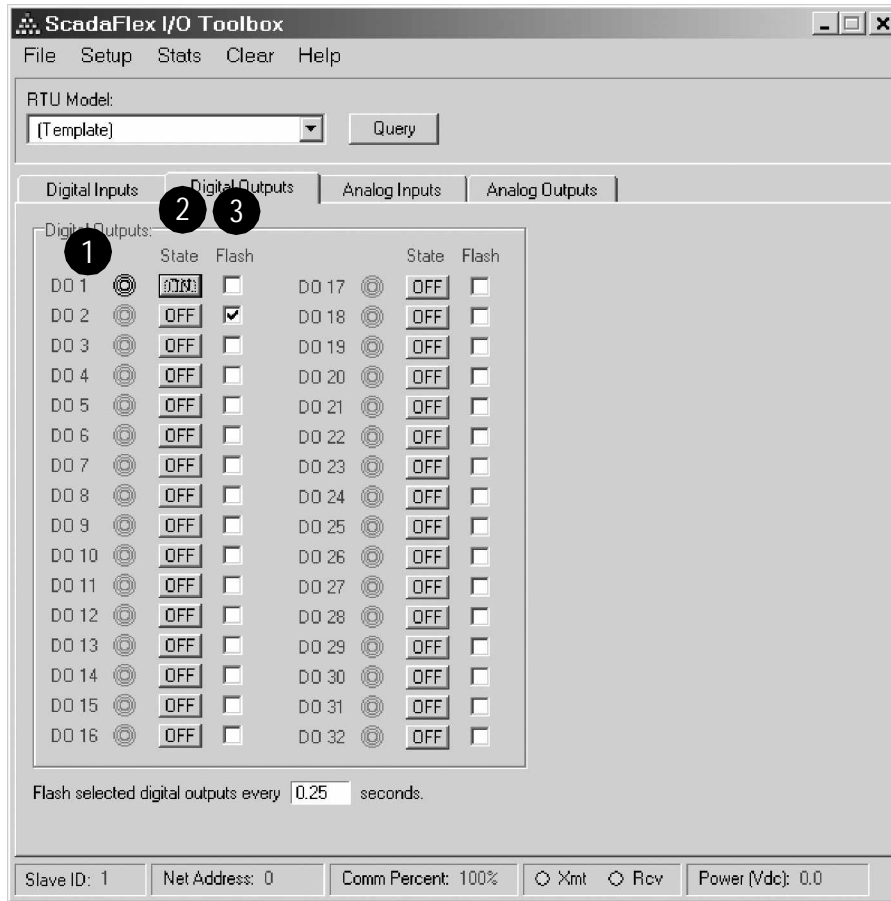
❶ Output Status Indicators

The Discrete Outputs have individual status indicators that glow GREEN when the outputs are ON.

❷ ON/OFF and Flash Control

❸

Every discrete output point can be set ON or OFF. By setting a configuration flag, the output point will flash when the output is set "ON".

The flashing rate is user configurable. The value entered is HALF of the total flash period. For example, when configured for 0.25 seconds, the output will turn ON for 0.25 seconds, and OFF for 0.25 seconds. The total ON/OFF period will be 0.50 seconds, or 2 times per second.

Analog Inputs

All ScadaFlex family Analog Inputs have a measurement resolution of 16 bits (1 part in 65,535). Depending on the model, ScadaFlex I/O modules support up to sixteen analog input points as depicted below:
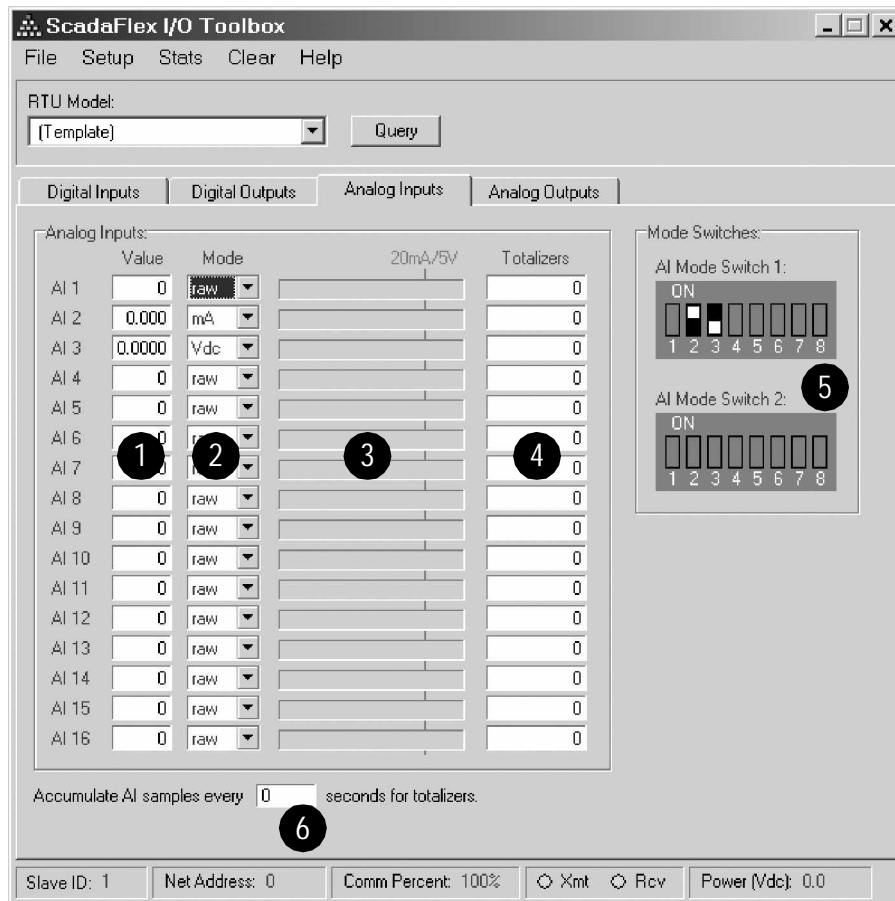
Most ScadaFlex I/O modules with analog inputs support multiple soft-ware selectable input modes; raw, current (20mA) and voltage (5Vdc). The raw mode is the "raw" uncalibrated, unscaled readings from the Analog to Digital converter circuitry in the module. In contrast, the current and voltage readings are calibrated and scaled.

1 Analog Input Level Display and Mode Selection
The Analog Input screen displays the current real-time readings from each of the analog inputs.

2 To the right of the readings are boxes that select the measurement MODE settings for each of the inputs.

When the mode is set to "raw" (uncalibrated), the readings will range from 0 to 65,535 as read from the Analog to Digital (A/D) converter.

When the mode is set to "20mA", the calibrated and scaled current readings will range from 0 to 20.000 for inputs of 0 to 20mA. The inputs can accurately measure over-ranges of more than 100%, so it's possible to get readings of 40.000mA or more when they are being overdriven.

When the mode is set for "5V", the calibrated and scaled voltage readings will range from 0 to 5.0000 for inputs of 0 to 5Vdc. The inputs can accurately measure over-ranges of more than 10%, so it's possible to get readings of 5.5000 or more when they are being overdriven.

3 Analog Input Totalizers

For analog signals that represent flow rate or consumption, ScadaFlex I/O modules can be configured to periodically sample and totalize the analog readings to approximate total accumulated flow or consumption. The totalizer registers are 32-bits wide, for a maximum value of 4,294,836,225 before they "roll over" to zero and count up again.

6 The analog totalizers sampling interval is user setable in seconds. The sampling rate is usually a compromise between resolution and update speed. Slower sampling times provide greater measurement resolution updated less frequently. 60 (seconds) is a frequently used value for the sampling rate, since it translates easily into engineering units such as "gallons per minute". Remember that the faster the sampling rate, the faster the value will grow in the totalizer register, requiring the Host system to grab the totalizer data more frequently so as not to "miss a rollover".
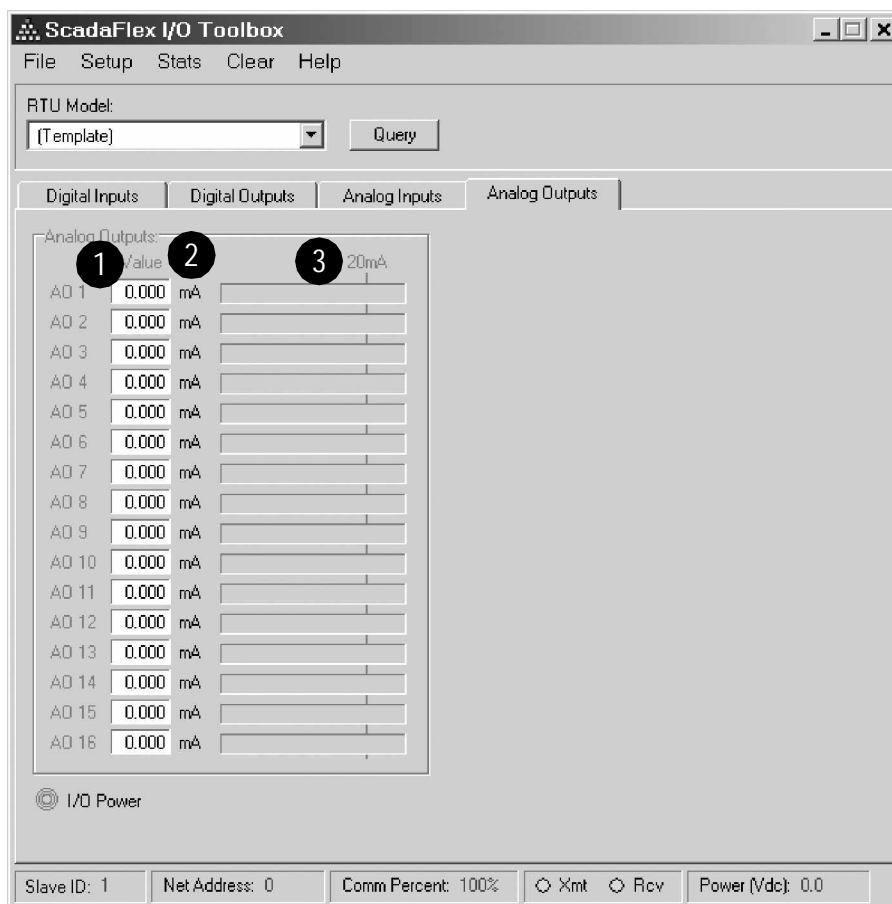
4 Bargraph Level Display

In addition to displaying digital values representing the analog input levels, the Analog Input screen has analog style bargraph displays for each input. These displays provide a quick indication of the relative signal levels. The 20mA/5V full scale points are marked toward the far right hand side of each bargraph.

5 Animated DIP Switch Display

Most ScadaFlex I/O modules with analog inputs support both voltage and current and have switches to enable precision shunt resistors for 20mA current measurements. As the modes are changed on the screen, the corresponding DIP switch settings are depicted on the far right hand side. Most modules have 8 or fewer analog inputs with only one switch bank with only the appropriate number of switches shown. One exception, MicroBrick AI-16 modules, have 16 analog inputs for which the toolbox will show two banks of 8 position switches.

Analog Outputs

All ScadaFlex family Analog Outputs have a resolution of 12 bits (1 part in 4,096). Depending on the model, ScadaFlex modules support up to sixteen analog output points as depicted in the screen image below:

1 ScadaFlex I/O modules with analog outputs support either current (20mA or 1mA) or voltage (10Vdc) levels. The Analog Output screen displays the current real-time output settings along the left hand side of the window. "Clicking" on a channels reading brings up a control window to change the output setting.

2 To the right of each output reading is displayed the measurement units appropriate for the I/O module being accessed.

3 In addition to displaying digital values representing the analog output levels, the Analog Output screen has analog style level bargraph displays for the outputs, providing a quick indication of each outputs relative signal level.

Configuration
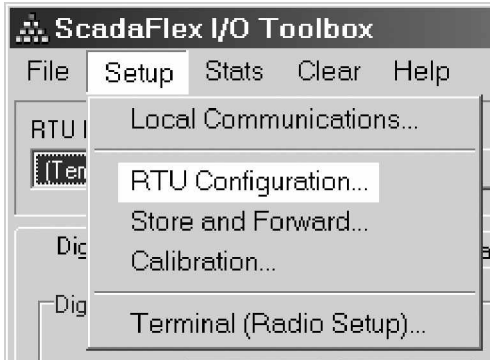
Each I/O module has non I/O type configuration parameters that may be viewed and set using the ScadaFlex I/O toolbox.

To access these parameters, click on "Setup" on the upper menu bar, and then "RTU Configuration" in the menu that pops down.

① Baud Rate
This sets the I/O modules communications data rate. The toolbox baud rate must match this value ("Local Comm Settings")

② Comm Failure Timeout
A communications link failure is detected if a valid message is NOT received within a set time period. If this happens, the I/O modules light a status LED, and analog or discrete output modules turn OFF their outputs. A value of zero disables this feature.
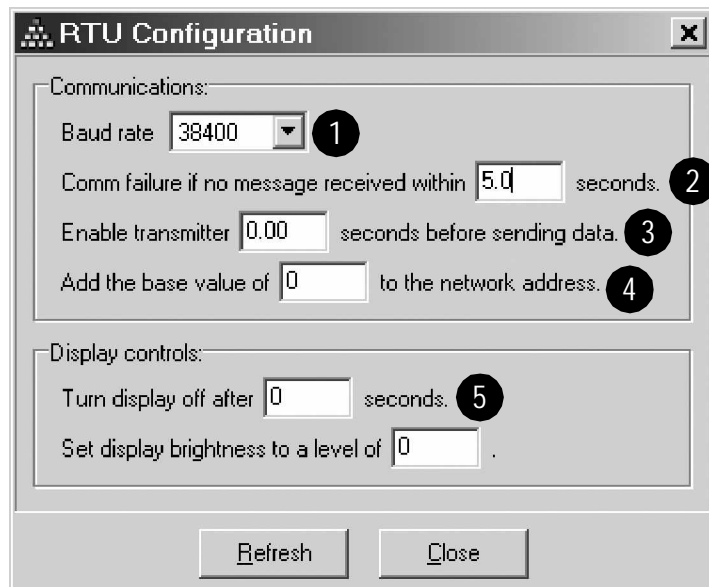
③ Transmitter Enable Delay
For RS-485 operation, set the time that the transmitter is turned ON before starting to send a message. This is typically 10mS (.01 seconds).

④ Network Address Base Value
For I/O modules that cannot select all possible 255 addresses in their configuration switches, this parameter sets a "base address" that is added to the modules switch setting to get a final network address.

⑤ Display Turnoff time and Brightness Level
For I/O modules with operator interface displays, these parameters set the power saver timeout time that turns off the display after a period of no keypad activity, and the brightness of the display (1 to 10) when the display is turned ON. A value of zero (0) disables the power save timeout feature.

Store and Forward
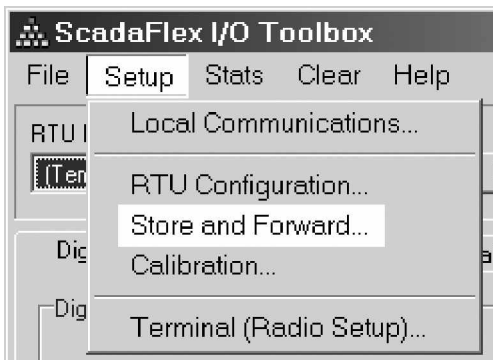
Each I/O module can serve as a Store and Forward digital message repeater for messages destined for other modules. This is typically used in wireless systems to effectively extend their coverage area.

To access the Store and Forward configuration parameters, click on "Setup" on the upper menu bar, and then "Store and Forward" in the menu that pops down.

① Incoming Base Address

Sets the start of the block of addresses to have their messages repeated.

② Outgoing Base Address

Sets the start of the block of addresses to which the repeated messages get mapped to.

③ Block Size (Range)

Sets the number of addresses that will be remapped and repeated.

Operation

To repeat Modbus messages, the repeated messages must have a different address than they come in with. The range and number of addresses to be translated, and the addresses that they are translated to, are set by these parameters. Setting any of these values to zero disables the feature.
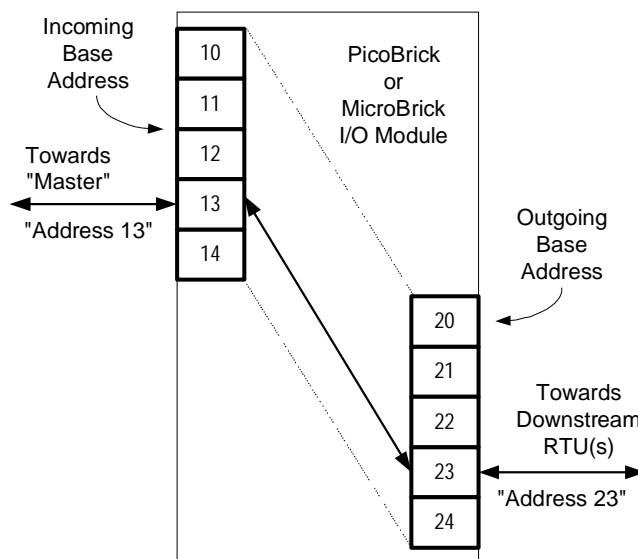
When the I/O module receives a message to be repeated, it translates the address, recalculates the checksum, and sends out the "new' message.

Calibration
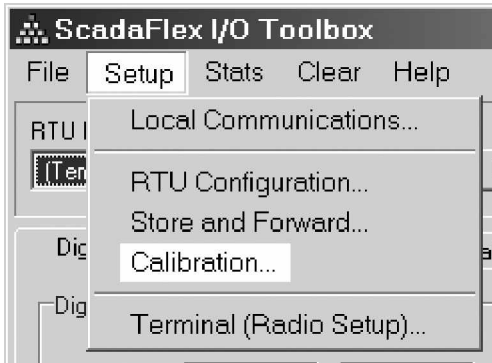
The inputs and outputs of analog I/O modules, as well as the power monitor of all modules can be calibrated using the ScadaFlex I/O toolbox.

To access the calibration menus, click on "Setup" on the upper menu bar, and then "Calibration" on the screen that pops down. Tabs on this screen then select between screens for calibrating individual module sections.

Calibration Overview

Calibration for ScadaFlex I/O modules is generally checked and adjusted annually if needed. Calibration of these modules is done electronically by storing compensation values in nonvolatile EEROM memory. These values are used by the modules microprocessor to calculate the readings that are placed into registers for a Host system. There are no mechanical adjustment devices within the modules.

20mA Analog Inputs

In ScadaFlex modules with 20mA analog inputs, a numerator for each channel is used to calibrate and scale the analog readings. The denominator is always 65,535 (16-bits). The resulting fraction is multiplied times the A/D converter reading whose maximum is 65,535. By design, no offset compensation is required. The full calibration formula is:

Reading x Numerator
        65,535

At the factory, 20mA current inputs are scaled to read 20,000 at 20mA.

Be sure to set the mode switches as shown for current mode calibration!

5Vdc Analog Inputs

In ScadaFlex modules with 5Vdc analog inputs, a single numerator for all channels associated with a group of eight inputs is used to calibrate and scale the analog readings. Modules with more than eight inputs have two calibration numerators. The denominator is always 65,535 (16-bits). The resulting fraction is multiplied times the A/D converter readings whose maximum is 65,535. By design, no offset compensation is required.

The full calibration formula is:

$$\frac{\text{Reading x Numerator}}{65,535}$$

At the factory, 5Vdc voltage inputs are scaled to read 50,000 at 5Vdc.
Be sure to set the mode switches as shown for voltage mode calibration!

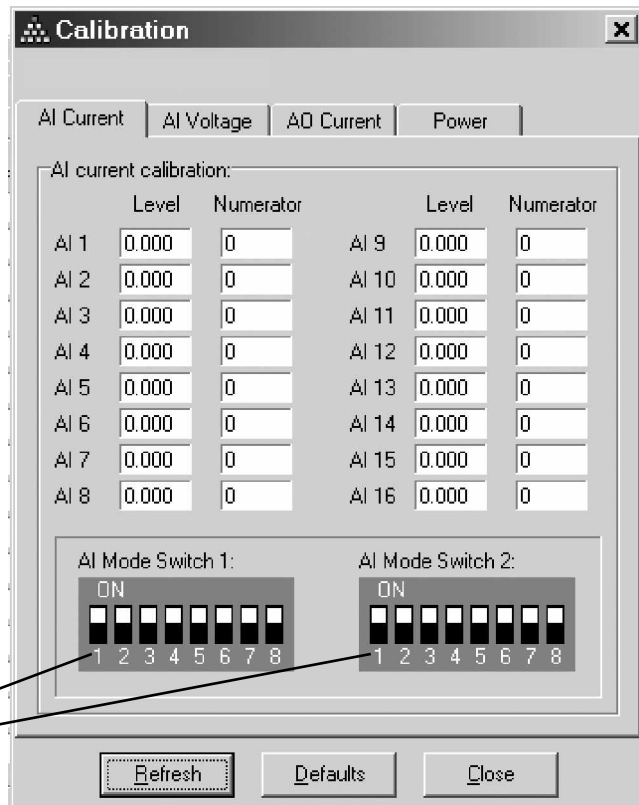## Analog Outputs

In ScadaFlex modules with analog outputs, a numerator for each channel is used to calibrate and scale the analog readings. The denominator is always 65,535 (16-bits). The resulting fraction is multiplied times the commanded output value and a signed offset value is added. 12-bit D/A converters are used with a maximum command value of 4,095.

The full calibration formula is:

$$\frac{\text{Command x Numerator}}{65,535} + \text{Offset}$$

At the factory, 20mA current outputs are scaled to read 20,000 at 20mA. 1mA current outputs are scaled to read 10,000 at 1mA.

Power Monitor

Most ScadaFlex I/O modules have a power monitor for the modules input voltage. A single numerator is used to calibrate and scale the analog reading. The denominator is always 65,535 (16-bits). The resulting fraction is multiplied times the A/D converter reading, whose maximum value is 1023. By design, no offset compensation is required.

The full calibration formula is:

$$\frac{\text{Reading x Numerator}}{65,535}$$

At the factory, the power reading is scaled to provide a 3 digit value with a 0.1 volt resolution (e.g. 12 volts would read 12.0, or a value of 120 in the Modbus register).

⚂ Calibration   ✕

| AI Current | AI Voltage | AO Current | Power |

Power voltage calibration:

	Level	Numerator
Vin	0.0	0

[Refresh]   [Defaults]   [Close]
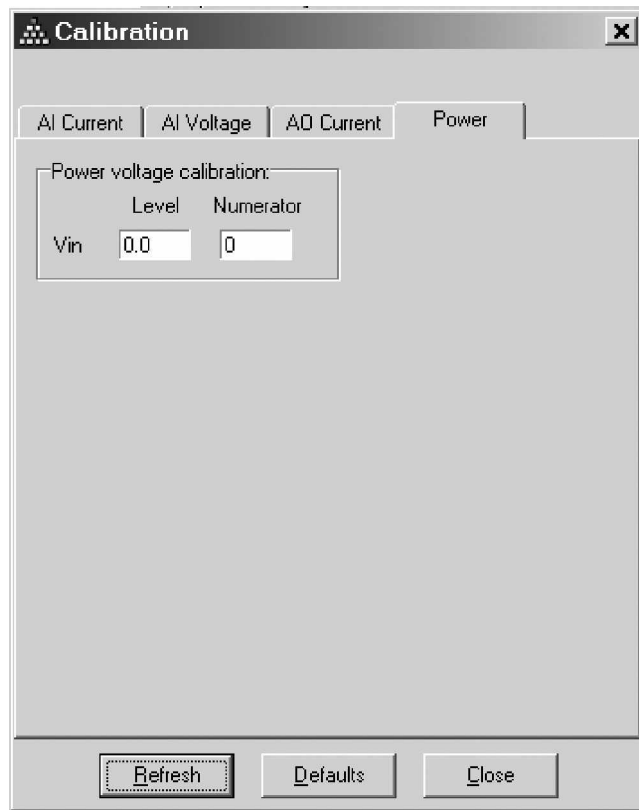
Internal Radio Configuration
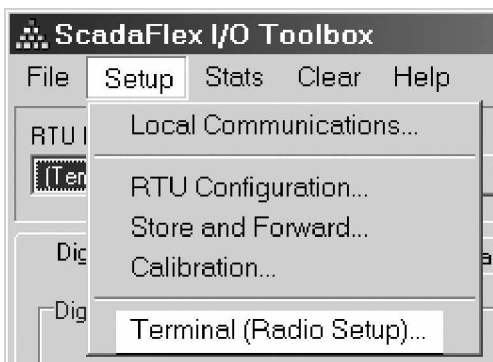
ScadaFlex RTUs are available with a built-in spread spectrum radio. The radio can be configured via a terminal emulator screen in the ScadaFlex I/O toolbox.

To access the terminal screen, click on "Setup" on the upper menu bar, and then "Terminal (Radio Setup)" in the menu that pops down. This will bring up a separate window with the terminal screen.

To "connect" the serial port of your PC to the internal radios serial port, you must set a pair of DIP switches on the side of the RTU. It is only necessary to change the left-hand two switches marked "RTU" and "MDM", not the six right-hand network address switches. The toolbox software indicates the proper switch settings as shown in the screen capture below:
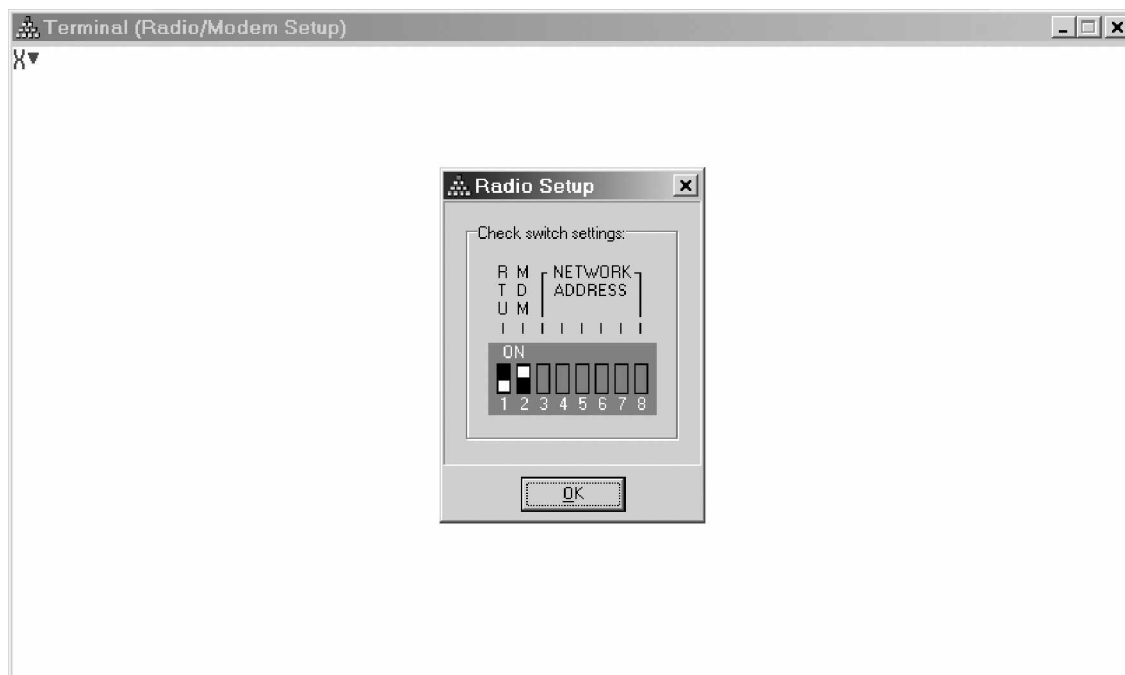
Radio Configuration - MAIN MENU

To bring up the Main menu from the radio, insert the end of a paper clip or similar object into the "reset" hole on the left side of the RTU enclosure.

When the radio has been placed into configuration mode, the radio status lights will glow green and the Main Menu screen will be displayed:

```
                         MAIN  MENU
                  Version  2.23  11-21-2002
                     Standard  Hop  Table
                 Modem  Serial  Number  911-8743

 (0)    Set  Operation  Mode
 (1)    Set  Baud  Rate
 (2)    Edit  Call  Book
 (3)    Edit  Radio  Transmission  Characteristics
 (4)    Show  Radio  Statistics
 (5)    Edit  MultiPoint  Parameters
 (6)    TDMA  Menu
 (8)    Chg  Password
 (Esc)  Exit  Setup

 Enter  Choice
```

From this menu, a series of sub-menus are accessed to examine or set operating parameters. The radios are highly configurable, but for most applications, only menus 0 (Set Operation Mode), 1 (Set Baud Rate), 3 (Edit Radio Transmission Characteristics) and 5 (Edit MultiPoint Parameters) are applicable and discussed in the remainder of this section. A full operations manual for the radios is available as a separate document upon request.

Exiting from Radio Configuration Mode

From any of the radio menus, you can restore normal radio operation and exit back to the "normal" toolbox screen by:

1) Pressing "ESC" (escape key in the upper left hand corner of your keyboard) three times to restore normal radio operation.

2) Click on the "Close" button ("X" in the upper right hand corner of the window) to close the terminal emulator window. Be sure to re-store normal radio operation BEFORE clos-ing the terminal window!

When the window is closed, the toolbox software will prompt you with a drawing of how to restore the switches back to their corrects settings.
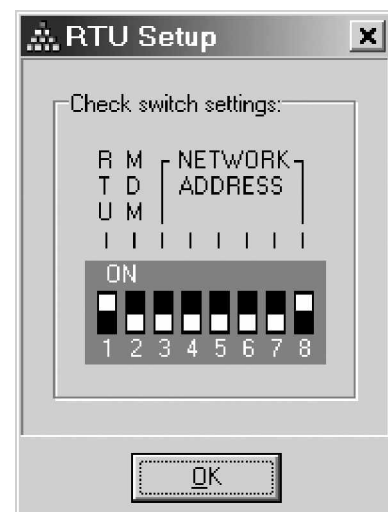
Radio Configuration - SET OPERATION MODE

The "Set Operation Mode" screen is selected by pressing "0" at the Main Menu. In this screen, the radios basic operating mode is chosen. The screen is depicted below:

```
                        SET  MODEM  MODE
                      Modem  Mode  is    2

  (0)     Point  to  Point  Master
  (1)     Point  to  Point  Slave
  (2)     Point  to  MultiPoint  Master
  (3)     Point  to  MultiPoint  Slave
  (4)     Point  to  Point  Slave/Repeater
  (5)     Point  to  Point  Repeater
  (6)     Point  to  Point  Slave/Master  Switchable
  (7)     Point  to  MultiPoint  Repeater
  (F)     Ethernet  Options
  (Esc)  Exit  to  Main  Menu


  Enter  Choice
```

The current operating mode for the radio is always shown at the top of this screen just under the title header.

Of the 9 available operating modes, only three of the modes are typically used with the ScadaFlex RTUs. These three modes are the "Point to Multipoint" operating modes:

Point to Multipoint Master

There must be one, and only one Master radio in a system, and all of the other radios in the network will operate as slaves to the Master. The Master must be set to selection #2 in the menu.

Point to Multipoint Slave

After a single radio has been designated as the Master, the remaining radios in the network must be configured as "Slaves" using selection #3 in the menu.

Point to Multipoint Slave/Repeater

To reach outlying areas in a network, Slave radios can also serve as repeaters. Slave radios that will also act as repeaters are configured using selection #7 (Point to MultiPoint Repeater) in the menu. Be sure to also enable Slave/Repeater operation in Menu #5 (Edit MultiPoint Parameters).

Return to the Main Menu

Once a radios mode has been set, press the ESC (escape key to get back to the Main Menu (only press once, or else you'll end up at the "C>" prompt).

Radio Configuration - SET BAUD RATE

The "Set Baud Rate" screen is selected by pressing "1" at the Main Menu. In this screen, the radios basic serial communication parameters are chosen. The screen is depicted below:

```
                              SET BAUD RATE
                         Modem Baud is   115200

 (0)     230,400
 (1)     115,200
 (2)     76,800
 (3)     57,600
 (4)     38,400
 (5)     19,200
 (6)     9,600
 (7)     4,800
 (8)     2,400
 (9)     1,200
 (A)     Data, Parity     0
 (B)     Modbus RTU       1
 (C)     RS232/485        0
 (D)     Setup Port       3
 (E)     Turn Off Delay   0        Turn On Delay     0
 (F)     Flow Control     0
 (Esc)  Exit to Main Menu
 Enter  Choice
```

The current communications speed (baud rate) setting for the radio is always shown at the top of this screen, just under the title header. The baud rate can be set to any one of ten standard speeds by simply typing a 0 through 9 corresponding to baud rates of 1,200 baud to 230,400. Any of these speeds may be used with the ScadaFlex RTU EXCEPT for 230,400 baud. The speed selected MUST match the serial port speed selected for the RTU using the ScadaFlex I/O Toolbox

Parity

The radio supports the standard "Odd, Even or None" parity selections. For the ScadaFlex RTU, this MUST be set to NONE.

Modbus RTU

This parameter MUST be set to "1" (enabled), forcing the radio to keep the integrity of a single message as one packet instead of using multiple packets which does not meet Modbus standard timing requirements.

RS-232/485, Turn Off Delay, Turn On Delay and Flow Control

These features are not used in the ScadaFlex RTU and MUST be set to "0".

Setup Port

Set this parameter to 3. This enables both radio ports for configuration.

Radio Configuration - EDIT RADIO TRANSMISSION CHARACTERISTICS

The "Edit Radio Transmission Characteristics" screen is selected by pressing "3" at the Main Menu. The screen, with typical settings for a ScadaFlex Plus based SCADA system, is depicted below:

```
        RADIO  PARAMETERS

 WARNING:  Do  not  change  parameters  without  reading  manual

 (0)    FreqKey          5
 (1)    Max  Packet  Size    8
 (2)    Min  Packet  Size    9
 (3)    Xmit  Rate       1
 (4)    RF  Data  Rate       3
 (5)    RF  Xmit  Power      10
 (6)    Slave  Security      0
 (7)    RTS  to  CTS         0
 (8)    Retry  Time  Out     255
 (9)    Low power  Mode      0
 (A)    High  Noise      0
 (B)    MCU  Speed           0
 (C)    Remote  LED          1
 (Esc)  Exit  to  Main  Menu

 Enter  Choice
```

Most of the parameters in this menu are geared towards handling special circumstances by advanced users and should be left as shipped from the factory. One item though, "Remote LEDs", must be turned ON in order to enable the two status LEDS on the side of the case near the antenna connector. Be sure this parameter is set to a 1.

Most of the other parameters in this screen are used to optimize the radios operation in the event of problems in the field. They improve the operation of the radio in close proximity with other radio networks, in high (radio) noise environments, or to optimize the operation of the radio for certain mixes of data or types of protocols. In general, the radios are plug-and-play and these parameters are best left at the factory settings unless a technical support person recommends changing them.

Typically, your radio setup should match the screen pictured above.

Radio Configuration - EDIT MULTIPOINT PARAMETERS

The "Editing MultiPoint Parameters" screen is selected by pressing "5" at the Main Menu. The screen, with typical settings for ScadaFlex, is depicted below:

```
                    MULTIPOINT PARAMETERS

(0)    Number  Repeaters        1
(1)    Master  Packet  Repeat   3
(2)    Max  Slave  Retry        9
(3)    Retry  Odds              9
(4)    DTR  Connect             0
(5)    Repeater  Frequency      0
(6)    Network  ID              30
(7)    Reserved
(8)    MultiMaster  Sync        0
(9)    1 PPS  Enable/Delay     255
(A)    Slave/Repeater           0
(B)    Diagnostics              0
(C)    SubNet  ID         Disabled
(D)    Radio  ID           Not  Set
(Esc)  Exit  to  Main  Menu

 Enter  Choice
```

Number of Repeaters

Repeaters extend the range of a radio network at the expense of speed. Any radio can also serve as a repeater. Set this parameter to 1 if you are using ANY repeaters. All radios in the network must have the same setting.

Master Packet Repeat

With a high quality link, set to 0 or 1 for maximum throughput. With a poor quality link, a higher number will improve getting individual messages though at the expense of speed and throughput. For Modbus networks, this value must be set to 3.

Network ID

This parameter helps avoid conflicts with other radio networks. All radios in the network should be set to the same ID value. Other networks must use a different value. Set this to any value below 4095, except the default (255).

Slave/Repeater

Set to 1 if this radio is a repeater as well as a node on the network. Be sure to set the Modem Mode (Menu #2) to *(7) Multipoint Repeater* also.

Diagnostics

Set to 1 for this radio to provide diagnostic data back to the Master.

Saving and Restoring Configurations

The ScadaFlex I/O Toolbox can save and restore I/O Module configuration and calibration information on your local PC disk drive. You can back up your work in case you need to replace an I/O module in the future or "clone" the configuration of a module for other locations.
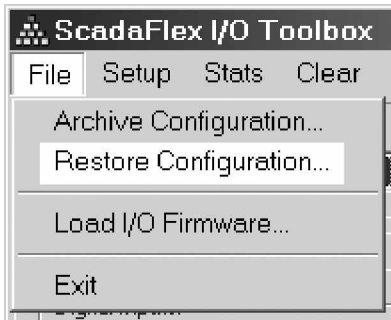
Archiving a Configuration
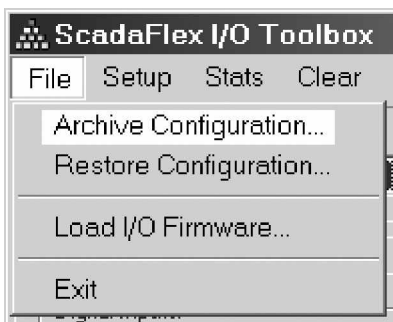
To archive or save a module configuration, click on "File" on the upper menu bar, and then "Archive Configuration" in the menu that pops down. This will bring up a separate Windows "File Save" screen similar to the one pictured below:

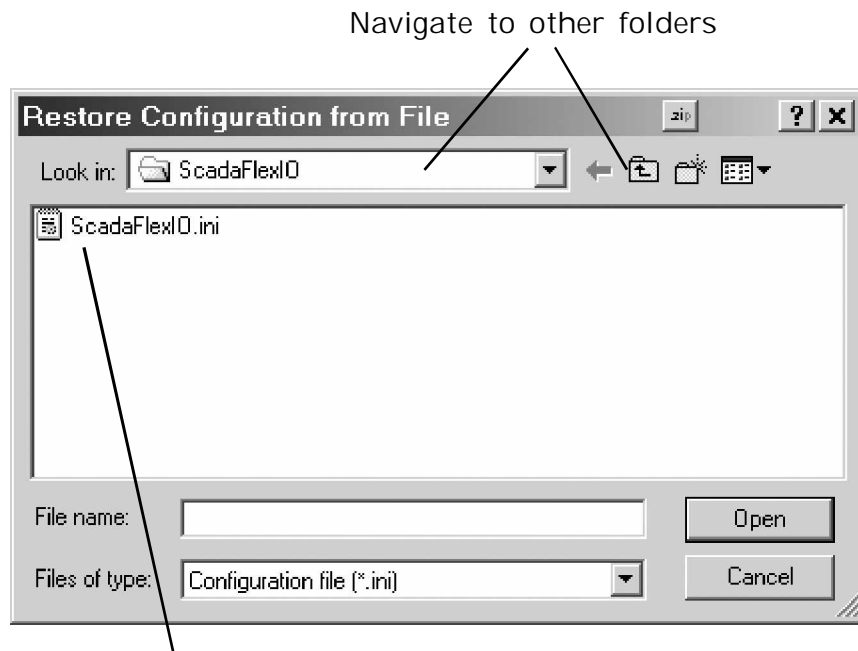Navigate to other folders
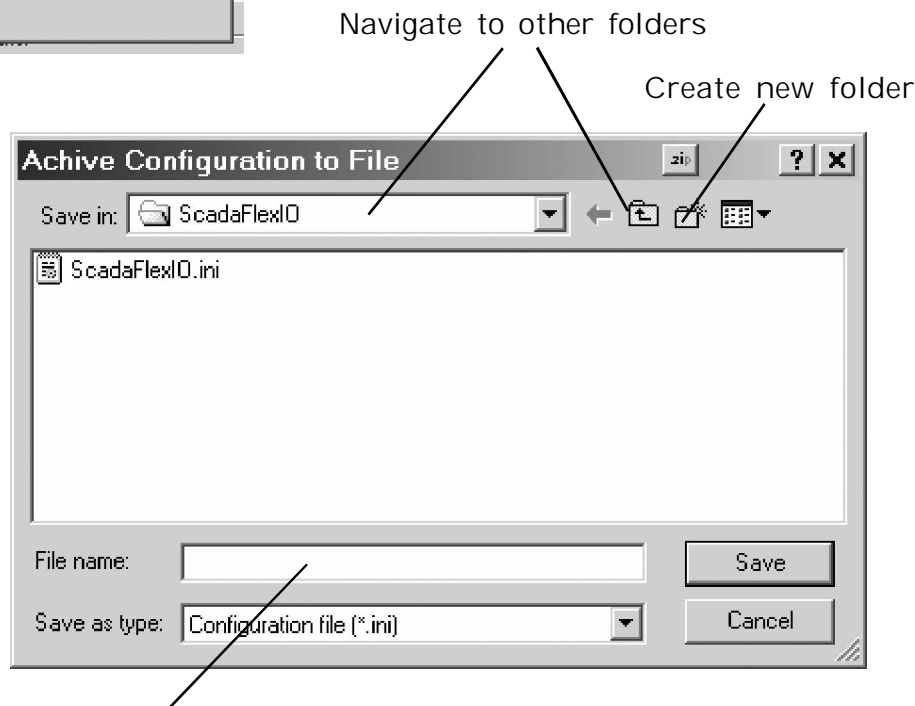
Create new folder

Enter a file name for the configuration file.

Be sure that you are "in" the folder in which you want to save the configuration file. Otherwise, navigate to the correct folder or create a new folder with the tool icons in the upper portion of the pop-up window. When you have selected or created the correct folder and entered a file name, press the "Save" button to complete saving off the I/O modules configuration.

Restoring a Configuration

To restore a module configuration from a previ-ously saved archive file, click on "File" on the upper menu bar, and then "Restore Configura-tion" in the menu that pops down. This will bring up a separate Windows "File Load" screen similar to the one pictured below:
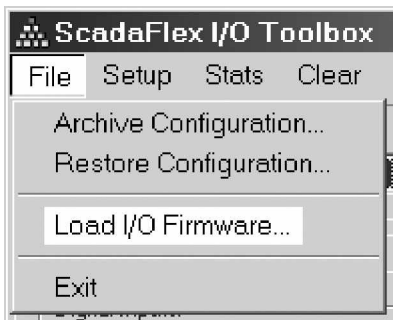
Navigate to other folders

Click on the desired configuration file to select it.

Be sure that you are "in" the folder that has the configuration file that you want to restore. Otherwise, navigate to the correct folder with the tool icons in the upper portion of the pop-up window. When you have selected the correct folder and file name, press the "Open" button to complete loading the archived I/O module configuration. If the I/O module is connected to the toolbox, it will automatically be loaded with the new configuration also.

Reloading I/O Module Firmware

Firmware is the programming built into the I/O modules that makes them function as I/O modules. The firmware programming is saved in nonvolatile Flash memory which can be updated in the field. The ScadaFlex I/O Toolbox can reload the Flash memory with new firmware if enhancements are made in the future. This ensures that your I/O modules always have the latest functionality without having to send them back to the factory.

Before attempting to load new firmware into an I/O module, be sure that your PC is connected and "talking" to it.

When you're ready, click on "File" on the upper menu bar, and then "Load I/O Firmware" in the menu that pops down. This will bring up a separate Windows "File Load" screen similar to the one pictured below:

Navigate to other folders
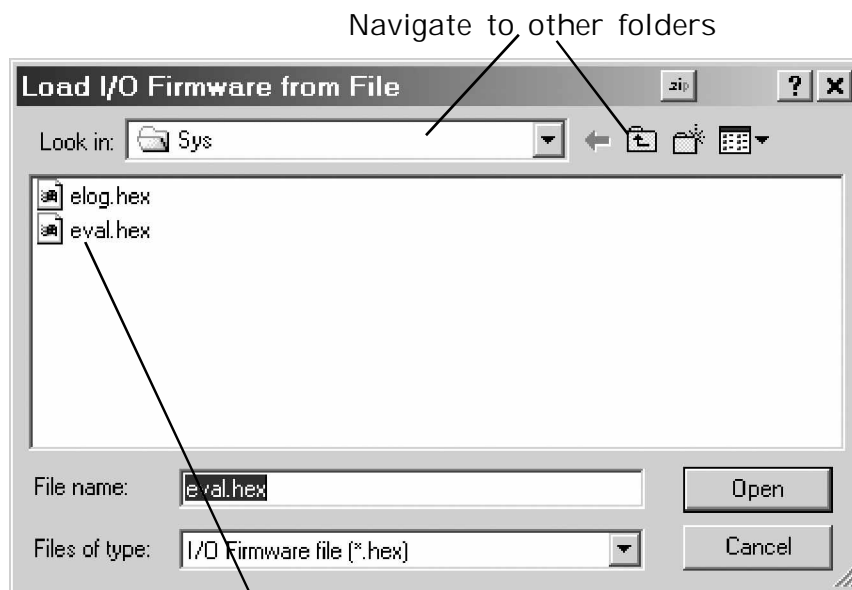
Click on the desired configuration file to select it.

Be sure that you are "in" the folder that has the firmware file that you want to load. Otherwise, navigate to the correct folder with the tool icons in the upper portion of the pop-up window. When you have selected the correct folder and file name, press the "Open" button to complete loading the I/O module firmware file (<name>.hex).

Once you've selected a file, the Toolbox will respond by displaying a screen similar to the one below asking you to "Reset the target".
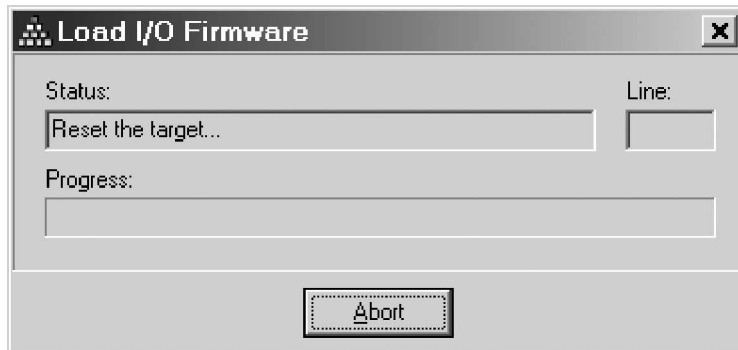
Momentarily cycle power to the I/O module.

You should see the download begin and the progress bar start to move across the window.

The download will complete in less than a minute.

Communications Statistics

The ScadaFlex I/O Toolbox maintains detailed statistics for the serial communications to the I/O module. This feature can be used to validate the quality of a communications link in the field in addition to verifying that the module is working properly "on the bench".

To display the communication statistics, click on "Stats" on the upper menu bar, and then "Communications Statistics" in the menu that pops down.

This will bring up the communications statistics screen similar to the one pictured below:
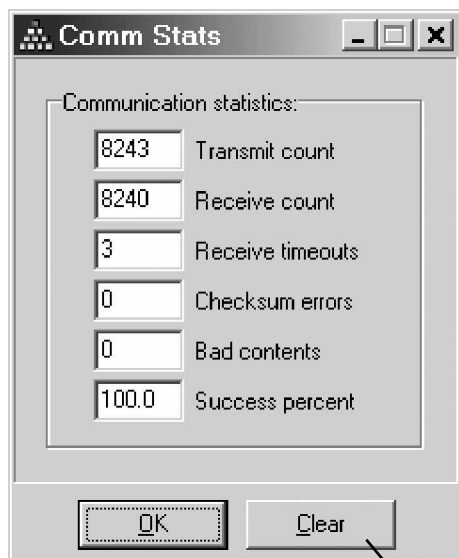
Statistics are kept continually as the Toolbox communicates with an I/O module. To clear existing values, for example, after connecting to a new unit, click on the "CLEAR" button.

A brief explanation of each statistical value is described on the following page.

Transmit Count

This is the total number of messages sent to the I/O module.

Receive Count

This is the total number of good messages received from the I/O module. On a perfect data link, the number of good messages received should equal the number of messages sent.

Receive Timeouts

This is the number of times that a response to a message sent by the Toolbox was not received "in time". The timeout time is user configurable (See "Connecting Up" earlier in this manual). This could mean that the message was either dropped or corrupted so badly that it was beyond recognition as a message, or simply took longer than the Response Timeout allowed.

Checksum Errors

This is the number of responses received with corrupted data caught by the message CRC check bytes. This is the most common type of message error seen in the field. In general, a few of these errors is not a problem, because the communications protocol automatically retries these failed messages. A large number of these errors should be cause for concern because these errors and retries will affect the overall performance of the communications link, and in severe cases, cause communication link failures.

Bad Contents Errors

This is the number of responses received in which the message appeared to have the correct CRC check bytes, but could otherwise not be interpreted properly. This is a very unusual but statistically possible error. The cause of these errors should be investigated if you see more than just one or two in thousands of message transactions.

Success Percent

This is a percentage calculated by dividing the number of good messages received from the I/O module by the number of messages sent out by the Toolbox. The value is an indicator of the relative quality of the communications link. A good quality communications link should be in the high 90's or 100%

Clearing the Totalizers

The ScadaFlex I/O Modules totalize transitions and runtimes for every discrete input and totalize (integrate) analog levels for every analog input. These accumulated totals can be retrieved by the ScadaFlex I/O Toolbox.
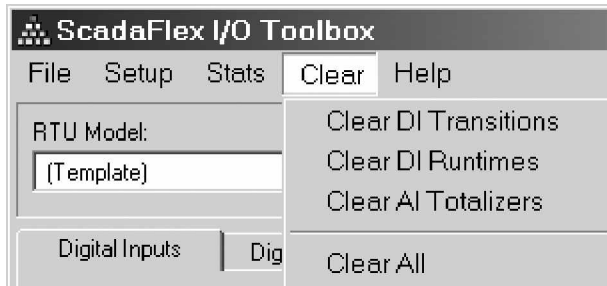
The Toolbox provides a facility for clearing the totals in groups or all at once. To access the totalizer clearing menu, click on "Clear" on the upper menu bar, and then "Clear DI Transitions", "Clear DI Runtimes", "Clear AI Totalizers" or "Clear All". The selected group of values will be set to zero.

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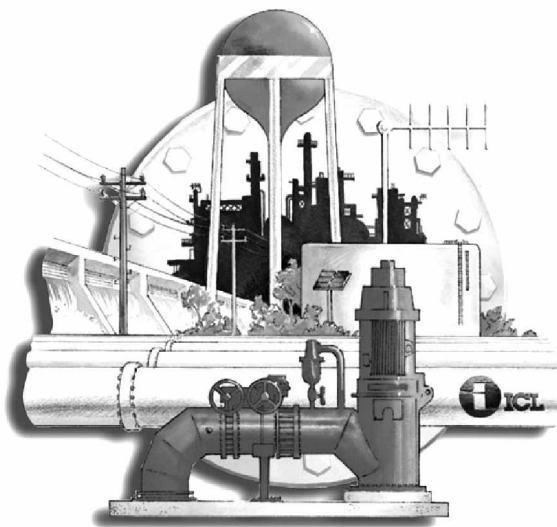
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