TechnoLogica™ 4.1 Control Software

For **Leonardo E-1** Interface

Quick Help to *Technologica* software

Welcome to *Technologica* software. This guide summarizes the primary elements needed to know in order to work with *Technologica*.
The guide has two parts:

I. "General Concept" and a list of the Primitive Commands.
II. "General Structure" and how to use the software.

I. General Concept

Technologica is a Control Software designed to work with *Leonardo* Interface. *Technologica* is used to control models built with K'NEX parts. In other words, you build K'NEX models using motors, lights, sensors etc., attach them to the *Leonardo* interface box and use *Technologica* to control the operation of the model.
Technologica is designed to be a highly user-friendly software and does not require any previous knowledge in computers or programming.

Technologica is provided in four levels:

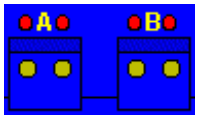
1. **Direct Level** is for young users.
2. **Automatic Level** is for new or novice users.
3. **Interactive Level** is for advanced users. It expands the Automatic Level to work with K'NEX sensors.
4. **Collaborative Level** expands the Interactive Level to work with several *Leonardo* interfaces using communication. Each *Leonardo* interface can send and receive information or commands from other *Leonardo* interfaces.

In general, when you work with *Technologica* you work on a **project**.
A project is a set of **Procedures** you design. A Procedure is an organized set of **Primitive Commands** and other **Procedures**. The Primitive Commands and the Procedures are used to interact with the ports on the Interface Box thus, operating the K'NEX model.

All Commands and Procedures are actually buttons on the screen. To operate (execute) a command, simply Click it.
Note: **Direct Level** uses only several of the basic Primitive Commands without the option of creating and editing procedures.

The principle of *Technologica* software is that at any given time, there is only one Output Port (A to D) that the computer **talks-to.** This port is called the **talk-to** port. From now on**,** every command is addressed to this Output Port. If you want to change the talk-to port, click a new one on the Interface image.

Primitives Commands



Talk-To Address an Output Port (A to D).

On Turn on the selected Output Port.

Off Turn off the selected Output Port.

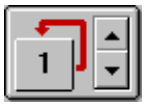
Reverse-Direction, Set-Direction Change/Set the Direction of the selected Output Port.

Set-Power Set the level of electricity power of the selected Output Port.

Flash Turn the selected Output Port on and off repeatedly.

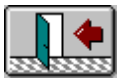
Delay Pause the flow of commands for a defined period.

Sound Produces a tone defined by its pitch and duration.



Repeat Repeat the following command (button), the number of times as set by the repeat button.

Utilities Buttons



Exit Button Allows you to return back to previous screen or exit the program.

Printing Button Allows you to print the current screen.

Help button Gives information about all the software instruction and everything else you can see on the screen.

Procedure Editor Moves you to the procedure editor to define or edit a procedure content.

Picture Editor Moves you to the picture editor to draw or edit a procedure icon.

Power Supply Status By clicking on this icon you get information on the power supply status of the Leonardo interface.

Interactive Level Concept

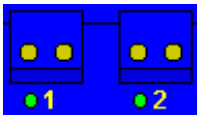
If you are using the **Direct Level** or **Automatic Level** of *Technologica* you may skip this chapter and read it later when you are more experienced with ***Technologica*** concepts.

Interactive Level expands the principle to work with the K'NEX sensors concerning the input ports (1 to 4). That is, at any given time there is only one input port that the computer **listens-to.** This port is called the **listen-to port**. All the input commands address this port. If you want to change the listen-to port, click a new one.

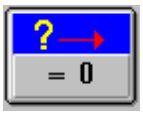
After you have attached and defined a sensor to an input port, you can watch the value it is currently reporting appear below the sensors image. These values are updated every half second.

Some of the sensors can operate in two types of operation. Meaning, the same K'NEX sensor can report different values according to the specific type defined to it. For example, the angle sensor can either report the rotation angle or the number of rotations. Therefore, you should set the sensor type according to the **specific** operation you want it to perform.

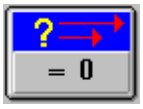
Additional Primitive Commands (Interactive Level and Collaborative Level only)



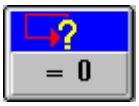
Listen-to Address an input port (1 to 4).



If-Then Test the current **listen-to** port according to the **condition** set on the button. If the result is true, the following command (button) will be executed. Otherwise, it will be skipped.



If-Then-Else Test the current **listen-to** port according to the **condition** set on the button. If the result is true, the first following command will be executed and the second following command will be skipped. Otherwise, the first following command will be skipped and the second following command will be executed.



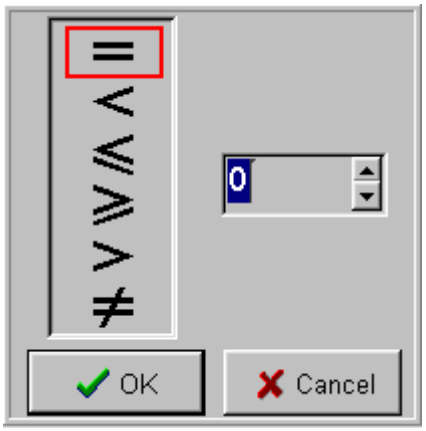
Wait-Until Test the current **listen-to** port according to the **condition** set on the button. As long as the result is false, the computer waits, as soon as the result is true, the execution of the following commands continue.

Reset Used to reset and adjust the values of the sensor ports (1 to 4) according to the kind of sensor. Not all types of sensors can be reset.

Condition Primitives (Interactive Level and Collaborative Level only)

The primitives: **if**, **if-else** and **wait-until** are called **condition primitives.**
These primitives test the current listen-to input port, according to the kind of sensor that is defined for that port and the condition that is defined by the user for that primitive.

Each condition command has two parameters: **operator** and **value**.
The operator can be either: $=, \neq, <, \leq, \geq, >$.



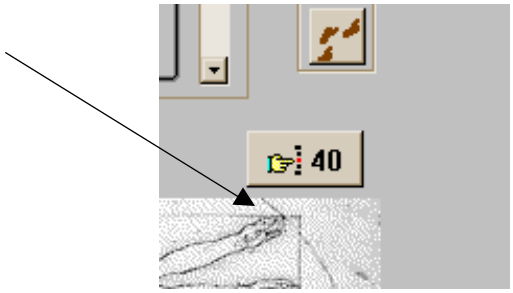
Collaborative Level Concept

If you are using **Direct Level** or **Automatic Level** or **Interactive Level** of ***Technologica*** you may skip this chapter and read it later when you are more experienced with ***Technologica*** concepts.

The **Collaborative Level** expands the principle to work with several *Leonardo* interfaces using communication. Each *Leonardo* interface can send and receive information or commands from other *Leonardo* interfaces.

Each *Leonardo* interface has an **ID** (a number between 1 and 99). The ID can be set in ***Technologica*** Main Screen.

At any time, ***Technologica*** is communicating with one Interface ID. In order for ***Technologica*** to interact with another *Leonardo* (which has a different ID) you should click the "Choose Interface" command button on the ***Technologica*** Main Screen.

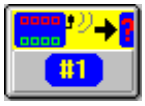


Note: Collaborative Level operates only in **wireless** communication mode. In order to communicate in Wireless Mode follow these steps:

One) disconnect the communication cable from the *Leonardo* interface.

Two) Reset the Leonardo interface (turn it OFF and then ON)

Three) Connect the communication cable to the RF-Modem and check that the RF-Modem is connected to the power supply (the RF modem Red led is on).

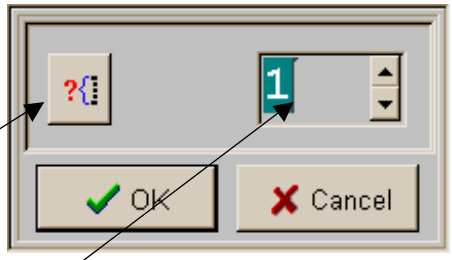


Command Interface #

The “Command Interface #” command sends the following command to the Interface ID which is set on the command button.
Note that the sent Command will be executed by the **other** Interface. It will NOT be executed by the current Interface.

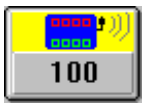
Setting Interface ID commands

The **Command Interface #** and **Listen to Interface #** commands - You need to tell the *Leonardo* interface what interface ID to control or listen to.



You may use the Test button to check whether an Interface ID you set currently exists in the room.

Set the interface ID here

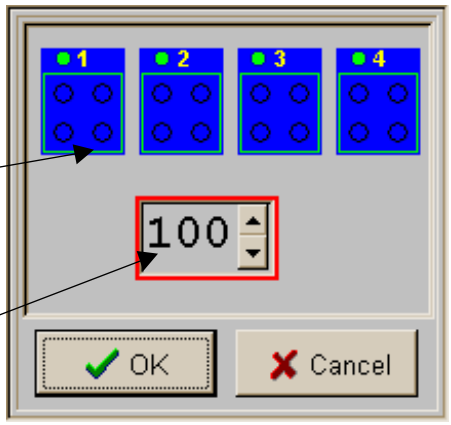


Send Value

The ”Send Value” command broadcasts a number into the air and continues the program execution.
This number can be either the current “Input Port” value or a specific chosen number (1..200).
This command is valid only in “Downloading Mode”.

Sending a Value

The Send Value command can send either a constant value or the value from a specific Input Port.

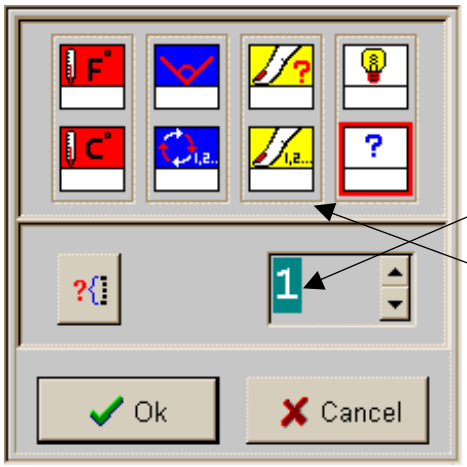


Choose an Input Port to send the value from that Input Port to the other Interface.

Choose a Value to send this specific value to the other interface.

Listen-to-Interface #

The "Listen-to-Interface #" command checks if a specific "Interface ID" had just sent a value (using 'Send Value' command).



You should set two properties for this command button:

1) Set the specific (other) 'Interface ID' that the current Interface will listen-to.

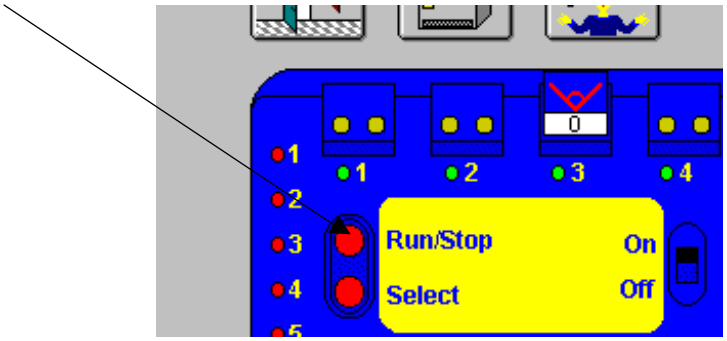
2) Choose the Sensor-Type you are expecting the other Interface to send (this value should correspond to the sensor type the other Interface is sending, in case of mismatch, the received value will be undefined). If you wish to receive a Raw number, you may choose the "question-mark" (raw) sensor type.

Operation: After placing this command in a procedure, it "replaces" the current **listen-to** port with listening the 'other' Interface.

This means that every **condition** command (If, If-Else, Waituntil) you will place in the procedure after this command, will check the value that was sent from the **other** interface (rather than the previous input port).

The "Stop-All" command

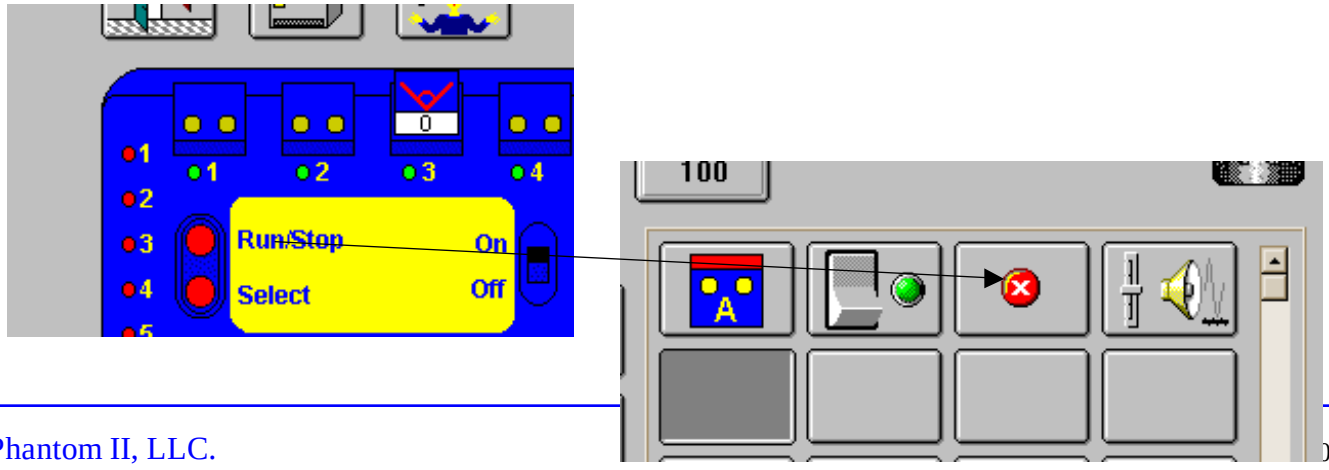
The "Stop-All" command is the *Leonardo* interfaces button "Run/Stop".



When you click this button on the Main Screen, it will either "Start Running" or "Stop Running" the current selected program (1 to 6) on the *Leonardo* interface.

In the Editor Screen the Run/Stop command button can be dragged from the Interface in order to place a "Stop-All" command button inside our procedure.
When "Stop-All" command is executed during program running, the execution of the program stops (same as clicking the Run/Stop button on the *Leonardo* interface).

In this example, the Tone command will never be executed, since the program will stop after the On command.



II. How to use *Technologica* software

Using the on-line help

Technologica provides detailed on-line help windows. Activate the Help Window by clicking the **help** button, located at the upper left corner of every screen, second from the left.

After activating the Help Window, click the item you want help about. You may click as many item as you need.

To close the Help Window and return to regular work, click the **close** button on the Help Window.

The structure of *Technologica*

Technologica has four main screens:

- *Projects Screen*
- *Main Screen*
- *Picture Editor Screen*
- *Procedure Editor Screen*

Defining Procedures :

A **procedure** is an organized set of commands you design to be automatically executed one by one. The commands can be primitives or other commands (procedures) you had already designed.

A **procedure** has two properties: its **icon** and its **contents**. To design these two properties you use the **Picture Editor** and the **Procedure Editor** accordingly.

A new **procedure** button is built in two steps: first draw its icon (picture), then define its contents (set of commands).

The ***Picture Editor Screen*** is used to draw an **icon** for the new procedure button you are designing. Click the Picture Editor button (upper right) and then the **empty** button in the **procedures area**. The Picture Editor will open and you can now draw an icon using the drawing tools in this screen. It is recommended to draw a meaningful icon that will tell about the action of the procedure.

When you **exit** the Picture Editor and return to the *Main Screen*, you will have an empty new procedure which has, so far, only an icon.

The ***Procedure Editor Screen*** is used to design procedures.
To design a new procedure, click the Procedure Editor button (next to the Picture Editor button) and then, click the icon you have just created.
To add a command to a procedure, either a primitive or other procedure, drag it from its location into the procedure body area.
Command parameters (like any condition, or scale, if necessary), can be set either before or after dragging them to the procedure body area.
To remove a command from the procedure window, drag it into the trash.
When you **exit** the Procedure Editor you return to the *Main Screen*.

Using primitives in the Procedure Editor Screen:
The following commands relate to the command that is placed after them in the procedure. Here is a list of each command and the relation to the following command:

Repeat Place one command you want to be repeated after the repeat command.

If-Then Place one command after the if command. It will be executed **if** at the moment the condition is tested the result is true. Otherwise, it will be skipped.

If-Then-Else Place two commands after If-Else command. **If** at the moment the condition is tested the result is true, the first command will be executed and the second will be skipped. If the result is false, the first command is skipped and the second command is executed.

Command Interface # Place one command after that command. The command will be sent and executed by the *Leonardo* interface ID set on the command button.

Listen to Interface # The next Condition Command that will be executed will consider the value that was sent (meanwhile) by the other *Leonardo* interface.

To **exit** the Procedure Editor, click **Exit** and you will return to the *Main Screen*.

Choosing a project:

In the ***Projects Screen***, you choose a project you want to work on. It can be an existing project one or a new project. To choose a project, click it. After clicking the project, the *Main Screen* automatically opens and you can begin your work.

Operating a model:

Operating a model is done at the ***Main Screen,*** where you activate the **primitive commands** and the **procedures** you had designed.
The primitive commands are located at the lower left area of the Main Screen.
The procedures are located in the procedure area on the upper right area of the main screen.

To activate a primitive command you should click it.
Notice that some primitive commands have a scale located on them. They are activated in two steps: first, drag the scale to set its value and then, click the button to activate the command.
The set-direction primitive command has two circles that determine the direction of the electricity. You should first click the desired circle and then click the button itself to activate the set-direction command.

Sensors and additional commands: (Interactive and Collaborative Levels only)

Interactive and **Collaborative** Levels allows the use of sensors to control the model operation. To use sensors you have to notify the computer which sensors have been attached to the Interface Box.
To notify a sensor (attached or removed) for an input port, double click the input port and choose the type of sensor from the pop-up options (you may also click both mouse buttons), according to the type of sensor you have attached to that port on the interface box, and the kind of operation you want it to perform.
For example, to set an angle sensor to count rotations for port 4, double click port 4 and from the pop-up options click the rotation counter sensor type.

To set parameters to a condition command, click the condition command button (on its lower area) and choose, from the pop-up options, both, the operator and the value. The operator can be either: **=** , **≠** , **<** , **≤** , **≥** , **>**. The value can be **a number**
For example, to set the condition > **10** for the **if** primitive, click the condition area, click > and set 10 on the pop-up options. Then, click the **OK** button.

You can also use procedures to operate the model. The **procedures** you design are located at the upper right area of the Main Screen. A procedure is constructed of primitive commands and other procedures. It will be explained later how to run a procedure.

Operating advanced primitive commands in the Main Screen
(**Interactive Level** and **Collaborative Level** only):

Repeat After clicking the button it remains pressed, waiting for you to click the command you want to repeat. Only after you chose the command, the computer will execute it a number of times according to the number set on the **repeat** button. To set the right number you can use the **+** and **-** buttons.

If-Then After clicking the button it remains pressed, waiting for you to click the command you want to be executed if the condition will be true.

If-Then-Else After clicking the button it remains pressed, waiting for you to click two commands that one of them will be executed according to the result of the condition. If the condition is true, the first command will be executed and the second will be skipped. If the condition is false, the second command will be executed and the first will be skipped.

Wait-Until After clicking the button, it will open the running window that will be closed only when the result of the condition is true.

Reset Click the button to reset the current **listen-to** input port.

Running Modes:

Technologica has two operation (running) modes

1) Download running mode – the whole procedure is downloaded into one of the 6 programs of the *Leonardo* interface. Then use the "Run/Stop" button run the procedure.

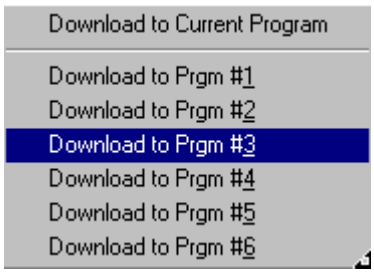
2) PC running mode – The PC executes the procedure commands by sending them one by one to the *Leonardo* interface. This is a "debugging" (step-by-step) mode.

1) Downloading and Running procedures from *LEONARDO* interface:

To download a procedure:

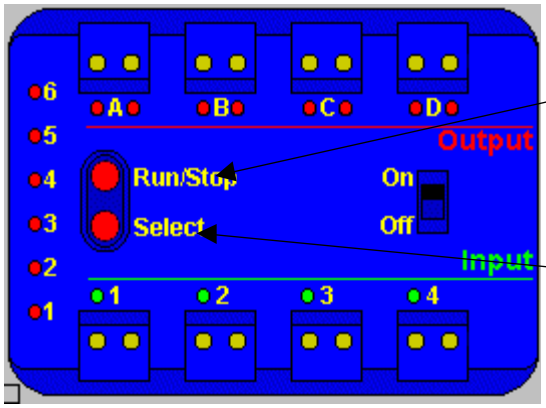
1. Choose the procedure that you want to download.
2. Click the left mouse button.

The following window will appear



1.Select one of the *Leonardo* programs that you want to save the procedure.
2. Click Enter, or click the left mouse button to start the download .

Running a downloaded Procedure:
The program that was downloaded can now be run both from the *LEONARDO* interface or the *Leonardo* image on the screen.



1. To run a chosen program, push the **Run/Stop** button on the *LEONARDO* interface, or click on the **Run/Stop** screen button.

Notice, The LED is flashing in a constant frequency

2. To stop the program, push again the **Run/Stop** button, or click this button on the screen.

The run another download program:

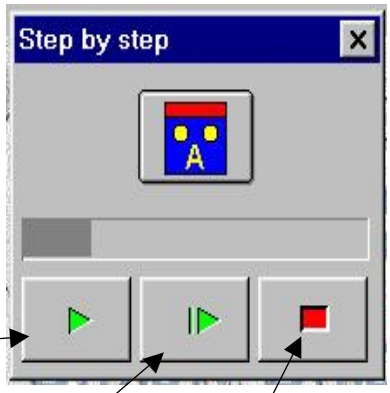
1. Push **Select** button until the program that you want to run is selected.

Notice, that the light that indicates the chosen program will flash on the interface.

2) Running a Procedure in a 'Step by Step' mode from the PC:

1. Make sure that the 'Step by Step' button is pressed
2. Click the procedure button you want to run.

The **Step by step** window will appear. This window will be automatically closed after the procedure will be finished.

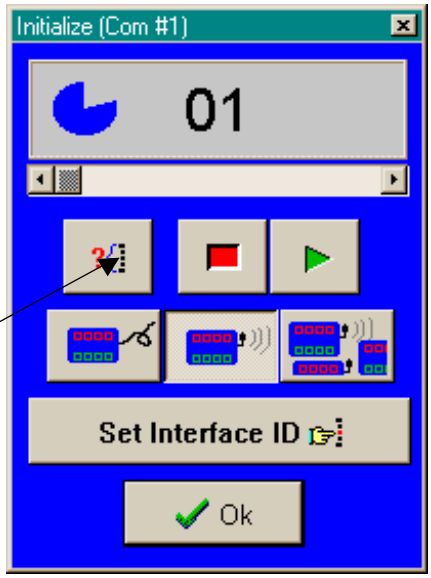


Clicking this button will run the procedure **successively**, showing each command that is executed

Clicking this button, the procedure will run the commands **Step by step**.
To execute the next command, click this button again.

The Stop button:
Clicking this button will stop the procedure and will set all Output Ports to **OFF**.

Identifying Interface ID

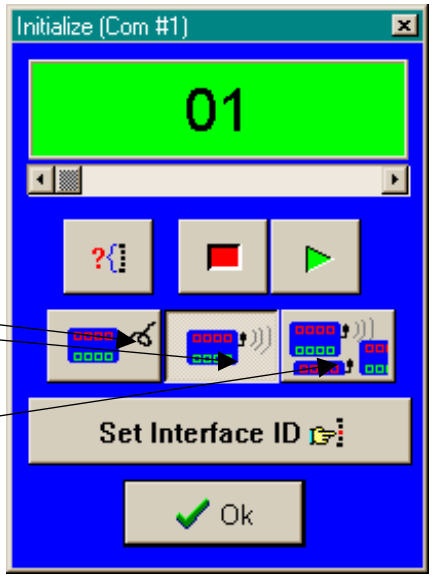


To find out the ID of a *Leonardo* interface:

1. Make sure that the *Leonardo* interface is connected to the computer.
2. Turn Off the *Leonardo* interface.
3. Open *Technologica* Main Screen.
4. Click the “Choose Interface” button to open the 'Set Interface ID' window.
5. Click the 'Search' button, *Technologica* is searching for an interface ID.
6. Turn On the *Leonardo* interface.

Within 10 seconds, *Technologica* should now identify the ID of the *Leonardo* you are holding.

Setting Interface Update Rate



Technologica is constantly updated by the statu s of the *Leonardo* interface.

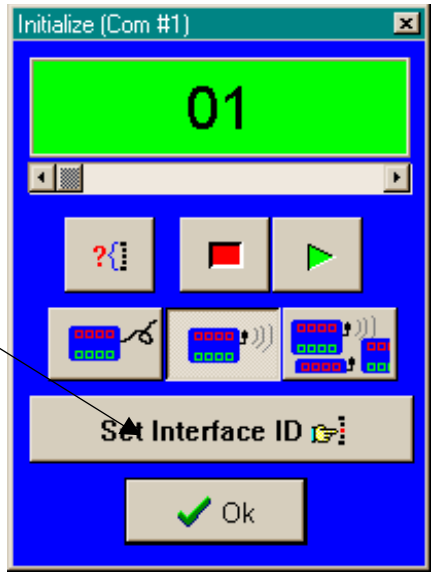
The rate of the updates can be either:

1. Cable Connection – Very quick updates, suitable only for cable connection.
2. Wireless Connection – Normal update rate, suitable for a single-user environment.
3. Collaborative Connection – Slower updates rate, suitable for an environment where several *Leonardo* interfaces operate simultaneously.

Notice that these option buttons are enabled only after the *Leonardo* interface is initialized (color of the top box is Lime).
The default connection rate is Wireless (option 2).

Changing an Interface ID

In order to change the ID of a *Leonardo* interface you need to open the Set Interface ID window and click the "Set Lenoardo ID" button.



Notice that this button is enabled only after the interface was found.

After the window is opened, follow the guiding steps that appear there.