

Smart Shelf Bar Code Scanner User's Manual

1. Introduction

NeWave's Smart Shelf solution is unique in that the shelf inventory is RFID tracked without tagging the items. It is done by placing RFID tags along the length of the dispenser trays used to hold the products. As the dispenser tray's pusher is moved back to hold more products, the spring used to force the products to the front of the shelf covers the tags in front of the pusher. Once these tags are covered by the metal spring, they cannot be read by the RFID system. Therefore, the tags that are not read define the position of the dispenser tray pusher, which then defines the amount of product in the dispenser tray. Since the tags are placed on the dispenser tray and not on the product, the product in the tray has to be defined in some way in order to know what product inventory is located in each tray. In order to automate this process, NeWave has developed a bar code scanner process to associate a specific product with a specific dispenser tray. This process is described in this document.

NeWave has placed a bar code label on the pusher of each of its dispenser trays. This bar code number corresponds to the header encoded into each of the RFID tags placed on the dispenser tray. Each of the tags on the dispenser tray has this header followed by sequential numbers starting with "01" at the front and ending with the number of tags on the tray, for example "08" for a tray with eight tags. Thus, longer dispenser trays have more tags and shorter ones have fewer. Since the tray tags are examined by the RFID system during installation, the number of tags is known for each dispenser tray before the system is fully activated in terms of its normal running operational mode. With this information, the Smart Shelf system can define the amount of product in each dispenser tray in terms of a percentage that is defined by the following equation:

Inventory percentage = (number of tags not seen) * 100% / (total number of tags on the tray).

In order to define the product placed in each dispenser tray, NeWave has added a bar code scanner and associated installation and maintenance software within the Nobel Smart reader. Note that the Nobel Smart reader is uniquely composed of two components: 1) small board computer and 2) RFID reader module. Thus, the bar code scanner software is easily added to the reader's small board computer. The use of this bar code scanner is explained below in terms of two procedures: 1) installation and 2) maintenance. In each process, one will see that the bar code scanner provides a very simple way to install and maintain NeWave's Smart Shelf system.

The logic used to execute each process is to begin using a “Start” bar code scan and then end using a “Finish”. If the “Finish” command is scanned, the input information will be loaded into the configuration file and this file will be loaded into the reader operational software as well as the user space within the small board computer so that the cloud operator can also obtain this new configuration or planogram. The reader operational software will then go into idle mode until the new configuration file is removed from the user space, which indicates that the new configuration file has been successfully loaded into the cloud server. Therefore, the Smart Shelf inventory data is not collected, processed, compressed and sent to the cloud server until the configuration file is synchronized between the reader and cloud server.

You will notice that some processes require a “Confirm” or “Abort”. The “Confirm” means that one agrees with the audio result indicated by the reader. The “Abort” means that one does not agree with the reader audio output. If the “Abort” is scanned the process will stop, none of the collected data during this process will be stored and the reader will go into idle mode. While in idle mode, one should correct the difference between his/her input and the reader audio output. For example during the installation process, the installer is asked to input the number of antennas connected to each antenna port on the reader. After this number is input, the reader will automatically check to make sure that this number of antennas is correct. If it is not correct for any of the four reader antenna ports, the installer must “Abort” the process and correct the problem by checking the actual connections to all the suspect reader ports. After the situation is corrected, the installer should scan the “Antenna Installation – Start”. This will re-start the whole antenna installation process from the beginning. This new command should re-start the process that failed. If the reader does not re-start, one should remove the DC power to the reader, wait a few seconds and then re-power the reader. Using this approach, the reader will start the whole installation plug-and-play process from the beginning.

2.0 Smart Shelf Installation

The Smart Shelf installation is based on the use of the bar code scanner that is connected to the Nobel Smart reader. When the Nobel Smart reader is powered up, it uses a plug-and-play operational concept. As a result, it begins its initial operation by recognizing that it does not have a “configuration” file, which is basically the shelf planogram that is needed within the reader’s processing software and at the cloud server. Since this file is not present the reader immediately goes into its antenna installation process as described next.

2.1 Antenna Installation Process

The antenna installation flow chart is shown in Figure 2.1. This chart defines the steps that are to be followed to complete the antenna installation process using the bar code scanner. As



Figure 2.1 Bar code scanner flow chart to complete the Antenna installation sub-process.

shown in Figure 2.1, the first step in this process is to scan the “Antenna Installation - Start”. This will activate the antenna installation process within the Nobel Smart reader. The reader will immediately ask the installer, via an audio output, to input the number of antennas connected to RF port #1 of the reader. The installer then inputs, via the bar code scanner, the number of antennas connected to port #1 of the reader using the number (0 through 4) bar code labels shown in Figure 2.1. Note that each port can have as many as 4 antennas and as few as 0 antennas. If more than 1 antenna is attached to any port, the reader must have a fan-out box connected to the reader to control an RF switch that is connected to this port. The RF switch can be used to connect 1 to 4 antennas to the reader port. This being the case, the installer has to make sure that the fan-out box and RF switches are properly connected to the reader using the instructions found in the “Nobel Smart Reader User’s Manual”. If this is not properly connected, the system installation will fail.

When the installer inputs the number of antennas connected a port, the reader will automatically check to make sure that this number of antennas is correct. If it is correct, the reader will output an audio message saying that “the number of antennas is correct”. If the number of antennas is not consistent, then the reader will output a message saying the following: “Not correct, there are N antennas connected to this port”. If the number of antennas is incorrect, the installer should record the number of antennas actually connected to each reader port so that he/she can correct the antenna deployment after examining all the reader antenna ports. **Note that all the reader antenna ports must be checked whether correct or not before a “Confirm” or “Abort” can be bar code scanned. This is necessary to make sure that all the reader antenna connections are corrected at once.**

Next the reader will ask for the installer to define the number of antennas connected to the next port. If all the number of antennas are correct, the reader will output a message indicating the total number of antennas connected to the reader and the installer should scan the “Confirm and Finish” bar code as shown in Figure 2.1. If the antenna deployment is incorrect, the installer should scan the “Abort” bar code. If the “Abort” is scanned, the reader will remain in idle mode waiting for the antenna deployment to be corrected. Once corrected, the installer should restart the “Antenna Installation” process. Using another approach, the installer could power down the reader if the antenna deployment is incorrect. In which case, the installer can create the correct antenna deployment and then re-power the reader, which will re-start the plug-and-play process. In any event, once the antenna deployment is correct, the reader will automatically switch to the Smart Shelf Installation as described next.

2.2 Smart Shelf Planogram Installation Process

Now that the Antenna information is correct, the installer will continue to the next step, which is to scan the “Front Installation - Start” bar code as shown in Figure 2.2. Once this scan command is activated the system will recognize that the following bar code scanned inputs are for the front shelves. Under this command the installer should only input information for the front shelves. To begin this process, the installer starts at the upper left-most shelf in the front. Next, the installer scans in the “One Shelf Installation - Start”, which is the upper left shelf initially. Once this command is recognized by the system, it will output an audio message that tells the installer to scan a pusher. Thus, the installer scans the upper left most dispenser tray bar code. Once this scan information is received by the system, it will output to scan the product bar code. If the product does not have a UPC bar code, the installer should scan the “Product UPC Absent” bar

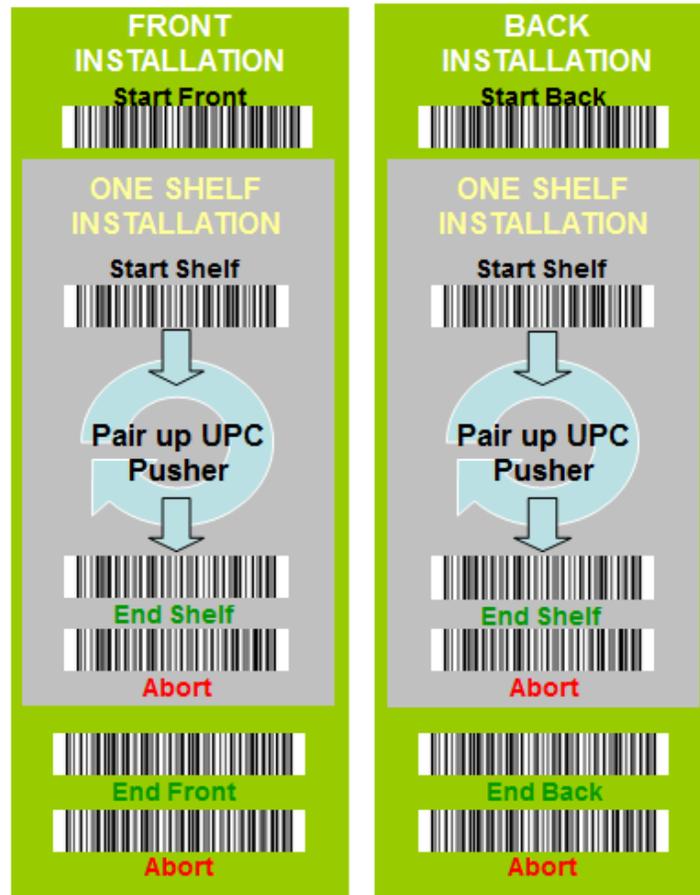


Figure 2.2 The Smart Shelf dispenser trays and products are scanned for both the front and back shelves with the tray bar scanned followed by the product bar code.

code as shown in Figure 2.2. Using this scan sequence the system recognizes that this dispenser tray and product set will be equated in the “configuration” file. This process is continued all across the top front shelf. Once all the dispenser trays and products have been scanned on the top shelf, the installer scans the “Confirm” under the “One Shelf Installation”. The system will then respond that the shelf information is complete. In addition, this information is loaded into the “configuration” file as the #1 front shelf once the installation is completed.

Normally, there is more than one shelf used in a Smart Shelf application. This being the case, the installer scans the “One Shelf Installation - Start” once again. This time the installer scans all the trays on the second shelf on the left hand side, which is directly below the top shelf that was just scanned. When this shelf is scanned, the installer again scans the “Confirm” to complete the second shelf scan. This continues until all the shelves on the front of the shelving system have

been scanned. When the front is completely scanned, the installer scans the “Front Installation” label marked as the “Confirm”. This will complete the front shelving installation in that all the front dispenser trays are related to specific products. Further, the locations of these products are also known by the order that the trays and products were scanned. All this information is then included in the “configuration” file, which is better known as the front shelf planogram.

If appropriate, the back of the shelving system is scanned as shown in Figure 2.2, which is done by scanning the “Back Installation – Start”. Once this process is started, the installer again does one shelf at a time starting with the left most top shelf and continuing to the lower right. Once all the dispenser trays and products are scanned on the back shelving system, the installer scans the “Back Installation – Confirm”. This will complete the back section and all this information on the back side will be loaded into the “configuration” file. Once this is done, all the dispenser trays and products have been properly scanned and properly related to the specific product loaded into each dispenser tray on the whole shelving system. This completes the initial installation process except for potential modifications that are discussed next.

As any process is being completed, it is important that the installer has to be able to easily correct any errors during the scanning process. For example, one may have an error during a shelf scan of the dispenser trays and products on a shelf. This being the case, the installer then bar code scans the “Abort” label rather than the “Confirm” label under the “One Shelf Installation”. If this is done the complete shelf results are removed and this shelf scan process must be re-started. In another case, the installer may realize that the shelving layout must change. If this happens, the installer can use the maintenance options described in the following section.

Once the bar code scanner input is complete and the “Finish” is read by the bar code scanner, the Smart Shelf software creates the complete “configuration” file and transfers a copy of this file to the user’s space in the small board computer. Once this file is seen by the cloud operator in his or her space, he/she immediately knows that the planogram has been completed and it must be uploaded to the cloud server. Once this file has been successfully removed from the user’s space, the system automatically starts the reader inventory process and collects inventory data.

Before going to the next section, NeWave has also created a video on how to do the installation using the bar code scanner. This video can be seen by activating the following video clip:

3. System Maintenance

The maintenance of the Smart Shelf system is also done using the bar code scanner. The maintenance flow charts using the bar code scanner are shown in Figure 3.1. Note that there are two maintenance options: 1) Antenna Maintenance and 2) Smart Shelf Maintenance. In order to activate either one of these Maintenance options, the reader automatically stops from running its normal RFID inventory data collection mode and switches to the appropriate maintenance software. This automatically happens when either the “Antenna Maintenance” or “Smart Shelf Maintenance” bar code as shown in Figure 3.1 is scanned. This operational change within the

reader may take a few seconds before everything is shifted from its normal operation to the maintenance mode process. The audio output will indicate when the reader is ready to do maintenance functions. The two maintenance options are described below.

3.1 Antenna maintenance

To start the antenna maintenance process, the maintenance person should first scan the “Antenna Maintenance” bar code as shown in Figure 3.1. This will activate the antenna maintenance process within the Nobel Smart reader. The reader will immediately ask the maintenance person, via an audio output, to input the number of antennas connected to RF port #1 of the reader. The maintenance person then inputs, via the bar code scanner, the number of antennas connected to port #1 of the reader using the number (0 through 4) bar code labels shown in Figure 3.1 under the Antenna Maintenance flow chart. Note that each port can have as many as 4 antennas and as few as 0 antennas. If more than one antenna is attached to any port, the reader must have a fan-out box connected to the reader that is used to control an RF switch that is connected to this port. The RF switch can be used to connect 1 to 4 antennas to the reader port. This being the case, the maintenance person has to make sure that the fan-out box and RF switches are properly connected to the reader using the instructions defined in the “Nobel Smart Reader User’s Manual”. If this is not properly connected, the system maintenance will fail.

When the maintenance person inputs the number of antennas connected a port, the reader will automatically check to make sure that this number of antennas is correct. If it is correct, the reader will output an audio message saying that “the number of antennas is correct”. If the number of antennas is not consistent, then the reader will output a message saying the following: “Not correct, there are N antennas connected to this port”. This being the case, the maintenance person should record the number of antennas actually connected to the reader so that he/she can correct the antenna deployment after examining all the reader antenna ports. **Note that all the reader antenna ports must be checked whether correct or not before a “Confirm” or “Abort” can be bar code scanned. This is necessary to make sure that all the reader antenna connections are corrected at once.**

Next the reader will ask for the maintenance person to define the number of antennas connected to the next port. If all the number of antennas are correct, the reader will output a message indicating the total number of antennas connected to the reader and the maintenance person should scan the “Confirm and Finish” bar code as shown in Figure 3.1 under the Antenna Installation heading. If the antenna deployment is incorrect, the installer should scan the “Abort” bar code. If the “Abort” is scanned the reader will remain in idle mode waiting for the antenna deployment to be corrected. Once corrected, the installer should restart the “Antenna Installation” process. Using another approach, the installer could power down the reader if the antenna deployment is incorrect. In which case, the installer can create the correct antenna deployment and then re-power the reader, which will re-start the plug-and-play process. In any event, once the antenna deployment is correct, the reader will automatically store this new

antenna information into the configuration file and re-start the normal Smart Shelf inventory collection process.



Figure 3.1 Bar code scanner flow chart and commands to do Smart Shelf maintenance.

3.2 Smart Shelf Maintenance

When the Smart Shelf Maintenance bar code is scanned, the reader will automatically output information about the present antenna deployment. This output will compare the antenna information within the Nobel Smart reader configuration file with the present connections. If these two antenna deployments agree, the reader will output that the antenna deployment is correct. If these two antenna deployments do not agree, the reader will output that the antenna deployment is not correct. This being the case, the Antenna Maintenance should be performed before the Smart Shelf maintenance is completed. This is easily done by bar code scanning the “Finish” under the Smart Shelf Maintenance category. Otherwise, the maintenance person should proceed with the Smart Shelf maintenance process.

The Smart Shelf maintenance function has four basic options to correct issues associated with the present planogram. These four maintenance options are described below.

3.21 Pushers Removed Option

This is used to remove dispenser trays from an existing Smart Shelf system. This option is activated by scanning the “Pushers Removed – Start” bar code as shown in Figure 3.1. Once this option is activated, the system will indicate this action via an audio response. After this audio response, the maintenance person is able to remove one or more dispenser trays by scanning each tray bar code that is to be removed. Once all the trays have been removed, the “Pushers Removed – Confirm” should be scanned. This will remove the chosen dispenser trays from the system planogram through changes in the “configuration” file. If one is removed by mistake, the maintenance person can scan “Pushers Removed – Abort”, which will cancel all the selected trays for removal. If this is done, the maintenance person can simply re-start this process and make sure to get the correct trays to be removed.

3.22 Pusher/Product Replaced Option

This is used to replace a single dispenser tray that is not functioning properly and/or defining a new product on an existing dispenser tray. To begin this process, the maintenance person should scan the “Pusher/Product Replaced – Start” bar code label as shown in Figure 3.1. Once this option is activated, the system will respond with an audio response and the old dispenser tray bar code is scanned first and then followed by the scan of the new dispenser tray bar code, which could be the same as the old dispenser tray. Once this process is completed, the maintenance person scans the product to be placed in this new dispenser tray. Using this command, the maintenance can remove a bad dispenser tray or use the same dispenser tray and define a new product on this dispenser tray. To complete this command, the “Pusher/Product Replaced – Confirm” bar code should be scanned. Through this process, the system will automatically change the old tray bar code number to the new one, if they are different, and define the product in this new dispenser tray in the planogram through the updated configuration file.

3.23 Pushers Checked Option

This is used to check the tags on selected dispenser trays. This command is activated by scanning the “Pushers Checked – Start” bar code as shown in Figure 3.1. Once this command is activated, the system will respond with an audio message. After the audio message, the maintenance person can then scan any dispenser tray bar code that he or she wishes. After a dispenser tray bar code number is scanned, the system will respond via audio output with the tag information provided that the scanned tray is located on the shelf and seen by the RFID system. This is very useful to check a suspected tray to make sure that all the RFID tag information is correctly seen by the RFID reader. After examining the dispenser tray tags, the “Pushers Checked – Confirm” should be scanned. This will end the

process. Nothing in the planogram or “configuration” file will be changed using this maintenance option.

3.24 Modify One Shelf Option

This is used to modify the planogram layout of an existing shelf. It is activated by scanning the “Modify One Shelf - Start”. The first step is to determine the shelf that has to be modified in the present planogram. This is done by bar code scanning one of the dispenser trays on this shelf that is being modified. The system will respond with an audio message that the shelf has been recognized and the maintenance person can proceed to redefine the shelf layout just as done for the original installation. In other words, the system will expect the dispenser tray to be scanned that is located at the far left of this shelf. This is followed by the product bar code to equate the product and dispenser tray information. This process continues all across this shelf. When all the dispenser tray and product bar codes have been defined properly, the maintenance person should scan the “Modify One Shelf – Confirm”. This will complete this process and all the new shelf information will replace the old planogram information.

3.25 Exit Smart Shelf Maintenance Process

Once all the Smart Shelf maintenance is completed, the maintenance person needs to exit this process. This is done by scanning the “Finish” bar code as shown in Figure 3.1. Once this process is ended, the Smart Shelf software will automatically switch operation to its normal operation. The maintenance person does not need to be involved in any additional action unless he or she is called or informed by the cloud operator. This is normally only done if there is something done wrong by the maintenance person. The cloud operator will notice that the planogram has been changed in that a new configuration file will be placed in the user’s space within the small board computer. The cloud operator or user will then see this new configuration file and transfer it to the cloud. Once at the cloud, cloud operator will remove this configuration file from the user’s space. The Smart Shelf system will recognize that everything has been uploaded to the cloud so that it can return to normal operation. If the cloud operator sees that the information is in error for any reason, the Smart Shelf data collection will not be re-started by the cloud operator in that he/she will not remove the new configuration file and the maintenance person will be informed on how to solve the suspected problem.