
THE P370:
A CUSTOMER SPECIFIC
SOLUTION FOR THE MOBILE
ENTERPRISE

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1. Introduction

This specific customer solution consists of many customized and unique components that when used together, seamlessly comprise an advanced and feature rich point of sale enterprise mobility system. The cordless P370 allows for data capture up to 150 feet from the point of sale host, yielding unparalleled flexibility and efficiency. The bi-directional flow of information delivers data to the point of activity enabling users to make mission critical decisions and verify scanned information. Application version and language control for the P370 can be managed from a single location, in addition to ensuring each device has the correct application and is up to date with the latest version.

Feature	Description
Bi-directional communication	Allows for price, description, and other data to be displayed on P370
JavaPOS bi-directional driver	Bi-directional communication using standards-based JPOS methods for application development
Magnetic label deactivation	Deactivates Sensormatic Ultra*Max security labels
Automatic application updates	Enables device to load new applications without user intervention
Multiple language capability	Supports up to ten languages, currently two in use (English, French)
Version control	Enables host system to identify, track, and control P370 applications
POS system functionality	Perform price lookup, quantity operations, Enter key and Escape key functions, respond to register prompts and messages
Multiple POS support	P370 application reconfigures device and changes data formats to function with five different customer POS systems
Custom RS-232 Y-Cable	Allows P370 and a slot scanner to share a single COM port on the host

Table 1.a - Feature Summary

The complete solution consists of five separate software components and two hardware components. Although some off the shelf software was used, (MCL-Link for example) other components had to be designed from the ground up or greatly enhanced to support the desired functionality. The Update Control Application and P370 application are new software innovations. Modified software includes the JPOS driver, scanner firmware, and cradle firmware. The Symbol generic JPOS scanner driver was used as the foundation for the new bi-directional driver, and the P370/PL370 firmware received many custom modifications and updates. The customer also made changes to their OS

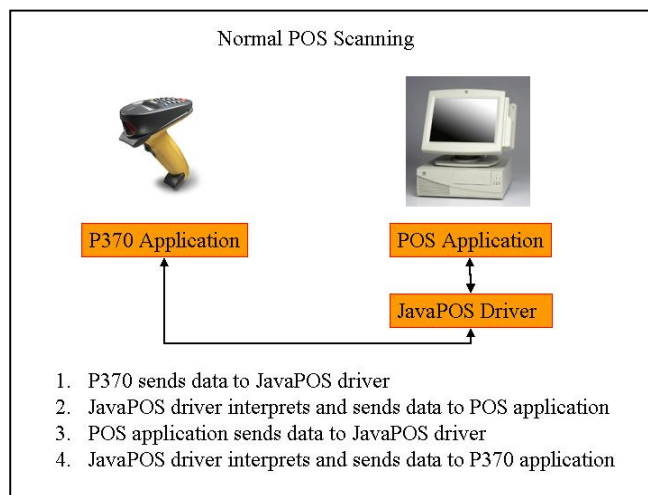
application to take advantage of the new features available from the bi-directional JavaPOS driver.

Product	Company	Function
JavaPOS Driver	Wincor-Nixdorf	Custom bi-directional driver
P370 Application	Symbol Technologies	P370 bi-directional application
MCL-Link Enterprise	Zetes Technologies	P370 application download
Update Control Application	Evolution Business Systems	P370 application version control
P370/PL370 Firmware	Symbol Technologies	Custom bi-directional firmware
Y-Cable P/N 25-64996-01	Symbol Technologies	Custom dual RS-232 cable
Magnetic Deactivator	Symbol Technologies	Sensormatic tag deactivation

Table 1.b - Component Overview

2. THE BI-DIRECTIONAL JAVAPOS DRIVER

The customer's point of sale system uses a JavaPOS driver to communicate with scanning devices. Symbol does have a generic JavaPOS driver, but it does not provide functionality for bi-directional communication, keyboard interface or display interface. Symbol contracted Wincor-Nixdorf to produce a bi-directional JavaPOS driver that incorporates many P370 application specific features to enhance the capability of the customer's point of sale system. The new driver is based upon the existing generic driver, but with customized Direct IO methods, advanced data parsing, timing controls, version detection, scan buffering, multiple device interfaces, and messaging capability. The driver is configured from an XML file, allowing for easy and flexible configuration.



In addition to providing basic scanner controls, the bi-directional JavaPOS driver functions as middleware interpreting messages between the POS application and the P370 application.

2.1 Creating our own JavaPOS

The requirement to use a JavaPOS driver with the P370 created many challenges. The P370 is a unique device and vastly differs from the common laser scanner that the JPOS scanner interface was designed to function. There are no methods to take advantage of a keyboard, display, or a battery operated cordless device within the existing JPOS scanning definitions. In order to make this work we had to customize our own JavaPOS Direct IO methods and data types, and develop a robust protocol for communicating with the P370.

2.2 P370 to JavaPOS

The P370 Bi-directional application does not directly communicate with the host application, rather the program actually interfaces with the bi-directional JavaPOS driver. The driver interprets the strings of data from the P370 and translates the information into a JavaPOS specific format so that the customer's POS application can obtain the data using JavaPOS methods.

JavaPOS DirectIO Data Types	Description
DIRECTIO_DATA_NOP370 = 0	Data from flat bed scanner
DIRECTIO_DATA_P370_SCAN = 1	Data from P370
DIRECTIO_DATA_P370_KEYED= 2	Data from P370 keyboard
DIRECTIO_DATA_P370_ESC = 3	ESC key pressed at P370
DIRECTIO_DATA_P370_PI = 4	Entering Price Inquiry
DIRECTIO_DATA_P370_OK = 5	Enter key pressed at P370

Table 2.a JavaPOS Data Types

The P370 application tags each transmission with identifiers that the JavaPOS driver can recognize. The above table represents the data types we can send from the P370 to the JavaPOS driver. Since we now have a JPOS representation for the data, the POS application can obtain the data using DirectIO methods. In addition to the data types above, the JavaPOS driver also recognizes 1) A "Sync" message from the P370, requesting the driver to resend the last message intended for the P370. This feature is present in case the user wishes to review the last transaction. 2) A Version identifier sent with each message, indicating the P370 application version. If the version reported from the P370 application is not a valid version, the JavaPOS driver or the POS application can prohibit usage of the device.

2.3 JavaPOS to P370

The JavaPOS driver sends messages from the POS application using our defined DIRECT IO display methods. The messages allow for a twenty-character display that can contain price, description, interactive prompts, or other register messages. The methods send an identifier to the P370 indicating how the message should be displayed on the scanner.

JavaPOS Direct IO Display Type	Value	Description
Normal	0	Display normal text message
Reverse	1	Display with dark background, white characters; Used to indicate a Price Inquiry lookup message
Alert	2	Display normal text message with alert tones (beeps)
Reverse and Alert	3	Display with dark background, white characters and alert tones (beeps)

Table 2.b Display Types

In this implementation, a Reverse display is used to indicate a price inquiry or price lookup. This is to distinguish a price lookup from a normal transaction. Alert tones are used to obtain the attention of the user.

3. THE P370 BI-DIRECTIONAL APPLICATION

The P370 runs an application that facilitates the bi-directional flow of information. It is essentially a shell that sends and receives messages, formats data, and performs other specific functions. Its main purpose is to accept input from the user, send messages to the JavaPOS driver, and then wait for responses from the driver. Since the MCL Interpreter on the P370 is single threaded, the device can only perform one task at a time. Thus the model of “send then listen”, and then repeat in a loop is a simple explanation of how the P370 application functions. The bi-directional messaging model allows the P370 to remain robust and flexible. All of the data messages between the host and P370 are performed in single transactions- every output message from the P370 gets a response message from the host. If a response is not received, then the user is alerted by a message from the P370 application. A response from the host confirms that the desired transaction occurred. Since a generic messaging model is used, the host can generate its own messages and prompts to the P370, such as asking for the “Number of feet” for a piece of wood, length of pipe, or remind the user to obtain warranty information from the customer.

3.1 Bi-directional Application Features

In addition to bi-directional capability, the P370 application is capable of performing several specific point of sale operations. Common features such as price lookup and quantity capability are now available on the P370. POS keyboard capability is also extended to the P370 by using the Enter and Escape keystroke features.

Implementation of these items permits the cashier to spend more time at the point of activity and less time traveling back and fourth to the POS system to perform these common operations.

Function Name	Keystroke	Description
POS Mode	<FUNC><3>	Allows user to choose one of five POS types
Price Inquiry Mode	<FUNC><1>	Enables price lookup
Quantity	<*>	Allows quantity value input
Sync	<UP ARROW>	Obtains last message sent from host
Escape	<DOWN ARROW>	Sends ESCAPE key
Enter	<ENTER>	Sends ENTER key

Table 3.a Application Functions

The POS Mode feature enables the device to communicate with five different customer POS systems, each with its own unique RS-232 parameters and data formatting requirements. The user can view the current mode, select one of five modes from a scrolling menu, and confirm the mode after selecting. The modes allow the P370 to be used across all current customer POS systems for universal deployment.



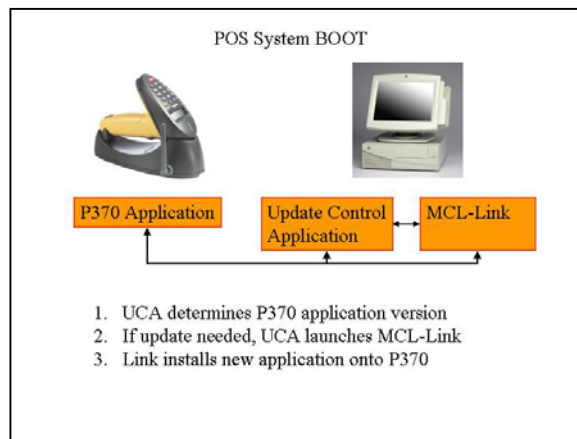
Specific point of sale operation is incorporated into the P370 application. This extends POS capabilities to the point of activity while scanning.

4. MCL-LINK ENTERPRISE

MCL-Link is used to perform the application download to the P370. MCL-Link and MCL-Link Lite are the only software tools available that will perform an application download to the P370. The MCL-Link software executes MCL scripts on the host that indicate the specific files to be downloaded to the P370. The interface is invisible to the user and requires no human intervention to operate. MCL-Link is initiated and controlled by another software application called the Update Control Application, or UCA for short.

5. UPDATE CONTROL APPLICATION

The UCA handles the P370 version control. It obtains the application version from the P370, makes the decision to perform an update, initiates, monitors, and terminates MCL-Link operations. This is done by communicating with the P370 from our own RS-232 messaging protocol, and communicating with MCL-Link from the available Link APIs.



5.1 The Update Process

When UCA executes, the program sends a version request message to the P370 that is sitting in the cradle. The P370 responds to the version request with its version information. The UCA compares the reported version with the values specified in its initialization file. If the version is correct, then UCA terminates. If the version is incorrect, then UCA determines the proper P370 application version and language, sends an update command to the P370 application, and then initiates the MCL-Link download process. UCA monitors the download via the MCL API commands. It can terminate the

MCL-Link process and restart it if necessary. Once the download is complete, UCA confirms that the proper version is on the P370 before terminating. UCA also has logging capability that records the details of the operation.

5.2 Why UCA?

UCA is a necessary component for the application update process. Although MCL-Link is capable of performing automatic application updates on its own, it requires the P370 to be used in a MCL-Host protocol instead of an RS-232 protocol. Since the rest of the solution requires the use of the RS-232 protocol, this means MCL-Link cannot provide the solution by itself.

5.3 UCA Configuration

UCA is configured from an initialization file (.ini). This file allows for set up of RS-232 parameters, timing values, repeat and retry attempts, MCL-Link control options, and logging options. UCA also handles selecting the proper language to be loaded onto the P370. The program is capable of supporting up to ten different languages each with its own independent application version.

6. THE P370 AND PL370 CUSTOMIZED FIRMWARE

Many changes to the existing P370 and PL370 firmware were required for this solution. Several of these changes are required to develop an efficient bi-directional solution utilizing the P370. The customized firmware is not compatible with the standard release firmware.

Product	Modification	Description
PL370	Y-Cable addition	Enables cradle to use synapse control lines to communicate with Y-Cable
PL370	Y-Cable default	Enables cradle to default to Y-Cable if no other cable detected on power up
PL370	Input data buffering after output	Allows base to output then quickly input without delay; vital to 2-way performance
PL370	Power/Charging	Initiates charging of P370 earlier, limits charging to cradle/paired P370
P370	"*" Hotkey	Stores input data on hotkey press for quantity input method
PL370/P370	SO/SI in cradle	Enables P370 to communicate via RS-232 while inserted in cradle
PL370/P370	General Improvements	Outstanding issue resolution, general improvements

Table 6.a Firmware Modification

7. THE Y-CABLE

The previous customer scanning solution consisted of either an LS4004 connected directly to the POS, or an LS4000 connected to the auxiliary port on a slot scanner. The addition of other RS-232 devices left only a single COM port is available for scanning. The only way to connect a handheld scanner to a POS utilizing a slot scanner was through the aux port. The aux port on slot scanners requires an undecoded (or “dumb” scanner) and does not allow for bi-directional flow of RS-232 data.



The Y-cable is essentially a “switch” synapse that is controlled by the PL370. It allows the P370 to share a COM port with another RS-232 device, in this case a slot or flatbed scanner.

A custom Y-cable was developed by Symbol engineering that allows the P370 and a slot scanner to share a single COM port. Instead of being connected through the slot scanner, the P370 is connected in parallel to the host. When the P370 needs to transmit data, the cradle uses the synapse lines to flip the connection from the slot scanner to the P370. Data coming from the host always goes to the P370. Data collisions from the P370 and the slot scanner are theoretically possible, but in order for this to occur both scanners would have to transmit at the same time. This can be prevented with the use of RS-232 flow control.

The firmware in the PL370 cradle has to be modified in order to control the Y-cable.

8. MAGNETIC DEACTIVATOR

The custom P370 has a nose magnet that can activate/deactivate Sensormatic Ultra*Max security labels. These labels are very common in the retail industry to prevent the theft of merchandise.

9. ABOUT THE AUTHOR

Gregory Carras is a Consulting Systems Engineer for Symbol Technologies, Inc. in the Southeast Area. His previous positions at Symbol include Associate Systems Analyst, Systems Analyst, and Mobile Solutions Specialist, where he focused on technologies such as barcode scanning, mobile data terminals, and mobility software tools. Greg has a B.S. in Computer Science from the University of Georgia. Prior to his joining Symbol in 1998, Greg was a software engineer at the Georgia Institute of Technology.

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