Tokheim Product Document

Controller-Dispenser Communication

CONTROLLER - DISPENSER

COMMUNICATION

Product Engineering
Tokheim Corporation
Fort Wayne, Indiana

July 3, 1997

Tokheim Product Document

Controller-Dispenser Communication

DOCUMENT HISTORY

Current Revision: 5.3 July 3, 1997	Prior Revision: 5.2 February 7, 1996

Page	Change
iii	Update Table of Contents.
3-1	Figure 3.1-1, Dispenser Function Codes, add AE 32, AE 46, AE 50, and AE 61 to list.
3-49, 3-50	Section 3.2.18.5, AE 46, Alter Maximum Delivery Settings During Sale, add command AE 46.
3-51, 3-52	Section 3.2.18.6, AE 50 Request Display Data Formats, add extended command AE 50 to request display formats for use with IFSF controllers.
3-53	Section 3.2.18.7, Add command AE 61, Return Dispenser Errors.
3-54, 3-55	Section 3.2.19, AF - Request Attendant Control Key Code, renumber pages.
D-6	Duplicate page, delete from document.
IN-1- IN-3	Update Index.

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DOCUMENT SCOPE

This document describes communication between Tokheim dispenser controllers and fuel dispensers.

General controller-dispenser communication requirements are summarized. Function codes are defined, showing the syntax for each controller command and dispenser response. In the appendices, characteristics of Tokheim dispensers and controllers which affect communications are discussed, and dispenser interface equipment is described.

This document is intended for internal use only. Any external distribution requires prior written approval by the Tokheim Engineering Manager.

The following documents contain additional information which may be required for a thorough undertanding of this software.

1) Attendant Control Key, Tokheim South Africa document # SA-010590.

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TABLE OF CONTENTS

LIST OF FIGURES

1.0 OVERVIEW

This section contains a description of the controller-dispenser system, a summary of dispenser groups, and definitions of terms.

1.1 DESCRIPTION OF SYSTEM

This document describes communication between a controller and one or more dispensers. Dispensers are connected to the controller through interface equipment; the required interface equipment depends on the dispenser type. In this document, the dispenser and dispenser interface equipment are treated as a single device, except where stated otherwise.

A dispenser is a physical device which may contain one or more logical devices called fueling points. A fueling point is defined as a set of one or more hoses, of which only one can be active at any time. One money display and one volume display are provided for each fueling point. Normally, one unit price display is provided for each hose and method of payment.

Figure 1.1-1 contains a system block diagram showing the communication path between a controller and dispensers.

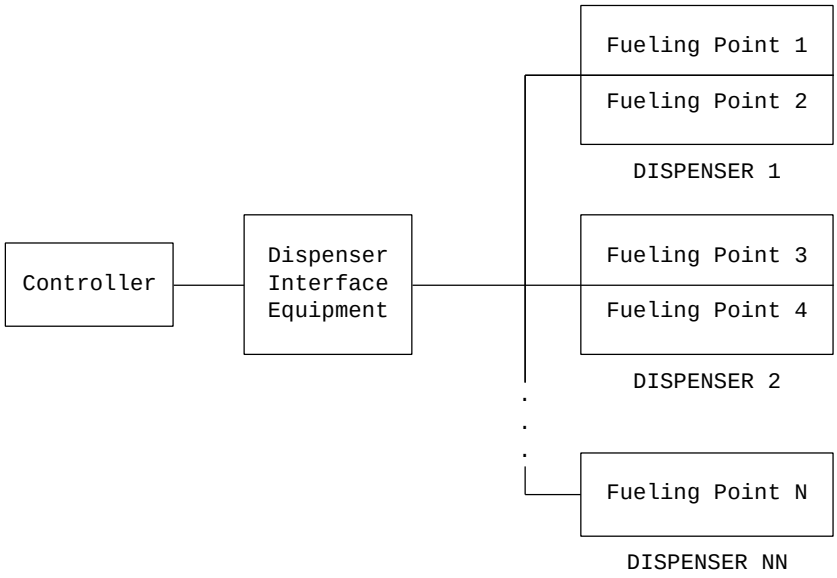


Figure 1.1-1. System Block Diagram

1.2 DISPENSER PROTOCOL GROUPS

Dispensers are organized for the purpose of communication into three groups: Group I (F8) dispensers, Group II (Euro F8) dispensers, and Group III (UDC) dispensers. Dispensers within each group communicate in a similar manner. Dispenser included within each group are listed in Figure 1.2-1, and described in more detail in Appendix B.

Group I (Domestic F8) Dispensers

Mechanical 1200 Series dispensers

Domestic 162 and 262 Series dispensers

330 and 333 Series MMDs

Retron dispensers

Group II (Euro F8) Dispensers

European 162 and 262 Series dispensers

UK Blender dispensers

S. Africa Bullet dispensers

Retron dispensers

Group III (UDC) Dispensers

TCS dispensers

Stand Alone MMD dispensers

262A dispensers

TCS Electronic blending dispensers

TCS Variable blending dispensers

Model 242/244 dispensers

Figure 1.2-1. Dispenser Protocol Groups

1.3 DEFINITION OF TERMS

The following terms are used throughout this document. Definitions are provided here to clarify their meaning.

Activate - initiate a sale at a fueling point by removing the nozzle from the nozzle boot and either raising a handle or pressing a button.

Authorize - send a command from a controller to a fueling point and receive acknowledgement, allowing a sale to begin.

AUX board - an integral part of the electronics in nonstand-alone multiproduct dispensers. The AUX board may be located in the dispenser or in the dispenser interface equipment.

Auxiliary displays - unit price displays on a multiproduct dispenser.

Command - a defined sequence of bytes sent from a controller to a fueling point. Each command contains a fueling point address and a function code; additional data bytes are required in some commands.

Controller - a device which initiates commands to a fueling point, using the command formats described in this document.

Dispenser - a single physical device which may contain one or two fueling points.

Dispenser interface - equipment required to connect the controller and fueling points.

Doubletalk - an error detection method which involves transmission of the binary complement following each data byte.

F8 - a type of microcontroller used within dispensers.

Fueling point - a set of one or more hoses, of which only one can be active at any time.

Function code - a predefined byte which corresponds to a particular function. Function codes are transmitted by a controller as part of the commands used to monitor and control fueling points.

Island authorization device - a controller which is located at the dispenser island and operated by a customer. An island authorization device can perform some of the monitoring and control functions normally provided by a controller.

Main displays - money, volume, and (in single-product dispensers) current sale unit price displays on a fueling point.

UDC - Universal Dispenser Controller; an electronic assembly used in several dispenser types. Dispensers using UDC electronics will respond to commands in a similar manner.

2.0 CONTROLLER-DISPENSER COMMUNICATION

This section contains general information on communication between the controller and the dispenser/interface equipment.

The controller initiates all communication with dispensers by issuing commands. Each command transmitted from the controller contains a fueling point address, a function code, and any required function code arguments. Commands are broadcast to all fueling points connected to the controller.

Most commands require a response from the dispenser/interface equipment. The fueling point which has been assigned the address included in the command will recognize and act on the command; other fueling points will ignore the command. The fueling point response (if any) normally contains requested data or status information.

2.1 COMMUNICATION CHARACTERISTICS

The communication characteristics described in this section are used in all controller-dispenser communications.

2.1.1 CONTROLLER COMMUNICATION

Figure 2.1.1-1 contains information on the controller-dispenser communication link.

Controller:	1 or 2 communication channels, with up to 8 or 16 fueling points on each channel, depending on controller model
Communication line:	One three-wire dedicated per channel, from controller to dispenser interface box
Directional characteristics:	Model 83/184/185 consoles - Full duplex Model 179/182/908 consoles - Half duplex
Data format:	Data transfer - Asynchronous Bit Rate - 9600 bits per second Data bits - 8 Stop bits - 1 Parity - None

Figure 2.1.1-1. Controller-Dispenser Communication Link

2.1.2 DOUBLETALK PROTOCOL

Data transmission between the controller and the fueling points uses the doubletalk protocol, in which each 8-bit byte is immediately followed by its binary complement. For example, if 90 Hex (10010000) is transmitted, the following doubletalk byte (identified as 90) would be 6F Hex (01101111). The doubletalk protocol provides bit-for-bit error detection.

2.1.3 ELECTRICAL CHARACTERISTICS

Electrical characteristics of the controller-dispenser communication link are listed in Figure 2.1.3-1. Negative voltages may be received, but are not required. Negative voltages are not transmitted.

Characteristic	Model 908 Controller	Other Controllers
Transmission:	Single Ended	Single Ended
Nominal signal level:		
Space	+12 V	+12 V
Mark	-12 V	0 V
Input Voltage:		
Space	+10 to +15 V	+10 to +15 V
Mark	≤ +2 V	≤ +2 V
Nominal output voltage: (open circuit		
Space (logic 0)	+12 V	+10 V minimum
Mark (logic 1)	-12 V	+0.3 V maximum
Output Device:	1488	75361A
Series output resistor:	≈300 Ω (internal to 1488)	47 Ω

Figure 2.1.3-1. Electrical Characteristics

2.2 FUELING POINT ADDRESSES

The controller initiates communication with the fueling points by issuing a command beginning with an address byte. The address byte contains a hexadecimal number: the upper nibble represents the address group, and the lower nibble represents the fueling point number.

Each fueling point on a communication channel is assigned a unique address. Figure 2.2-1 lists valid fueling point addresses.

ADDRESS	ADDRESS GROUP
Fx	Fueling point (x+1)[1]
ED	All fueling points
Cx	Stand-alone MMD or TCS fueling point (x+1)[1] (used only with Aux commands)
Dx	Nonstand-alone MMD fueling point (x+1)[1] or Stand-alone MMD or TCS fueling point configured for nonstand-alone MMD protocol (used only with Aux commands)

1) x = 0-F hex, corresponding to fueling points 1-16, respectively

Figure 2.2-1. Fueling Point Addresses

3.0 DISPENSER FUNCTION CODES

Dispenser function codes, transmitted from a controller to a fueling point, are used to send commands to a fueling point or to request data from a fueling point.

This section contains a list of function codes and function code descriptions, general notes on the use of function codes, and a definition of each function code. Appendix B contains a cross-reference to function codes by software release number and dispenser ID code.

3.1 LIST OF FUNCTION CODES

A list of function codes with descriptions and valid fueling point addresses is shown in Figure 3.1-1.

ADDRESS	FUNCTION CODE	DESCRIPTION OF FUNCTION
Fx	A0	Request fueling point ID
Fx	B0	Request Auxiliary Fueling Point ID
Fx	A1	Request fueling point display data
Fx	A2	Request fueling point status
Fx,ED	A3	Halt sale and turn valves off
Fx	A4	Resume sale and turn valves on
Fx	A5	Authorize fueling point
Fx	B5	Authorize fueling point
Fx	A6	Send data for fueling point main displays
Fx	A7	Reset fueling point
Fx	A9	Request single-product stand alone fueling point totals
Fx	A9	Request multi-product stand alone fueling point totals
Fx,ED	AA	Set fueling point display control data
	AB	Reserved for future use
	AC	Reserved for future use
	AD	Reserved for future use
Cx,Dx	AUX A1	Request activated hose and MOP
Cx,Dx	AUX A2	Acknowledge deactivated hose
Cx,Dx	AUX A3	Send cash prices for fueling point auxiliary displays
Cx	AUX A3	Send cash/credit prices for fueling point auxiliary displays
Fx	AE 01	Set UDC method of payment and product
Fx	AE 10	Request fueling point reserve
Fx	AE 20	Request fueling point unreserve
Fx	AE 32	Set UDC retail/fleet product restriction
Fx	AE 46	Alter maximum delivery settings during sale
Fx	AE 50	Request display data formats
FX	AE 61	Return dispenser errors.
Fx	AF	Request attendant control key code

Figure 3.1-1. Dispenser Function Codes

3.2 DEFINITION OF FUNCTION CODES

Each function code listed in Figure 3.1-1 is defined in the following sections. Controller commands are composed of a fueling point address, function code, and data bytes as defined in each code. Any exceptions to the general definition are noted as applicable in each code definition.

For each function code, this document shows valid addresses, a brief functional description, the format used for the controller command and fueling point response, and example commands and responses. The following information will aid in understanding and using these function codes.

All function codes, addresses, and data are shown as a series of bytes in hexadecimal form, except where noted otherwise.

Some commands and responses use two or more bytes to represent a single value. When this occurs, the order in which the bytes should be evaluated is indicated in the text, using the abbreviations shown below.

lsb = least significant byte
2sb = second most significant byte
msb = most significant byte

Some commands and responses include additional data bytes when used with certain dispenser types. These additional bytes will be shown within square brackets, and their use will be defined for each command. These bytes include a 1/2 P byte, an auxiliary status byte, and a product identification byte.

A 1/2 P (pence) byte can be used with U.K. Blender, and Euro F8 dispensers. When bit 3 in this byte is set to 1, 1/2 P should be added to the money amount indicated. This indicator is not in current use.

An auxiliary dispenser status byte is included in the response from some fueling points when configured for island authorization.

The following product identification bytes are used with U.K. Blender/Bullet dispensers to identify the fuel grade.

00 Idle or Single-product dispenser
20 High Grade
40 Blended Grade (U.K. Blender only)
80 Low Grade

A slow flow offset is specified by some commands. The slow flow offset (SFO) ranges from 00 to 7F hex (0 to 127 decimal), and is defined in the current unit of volume. The slow flow offset describes the point near the end of a preset sale when the fast flow valve closes and the remaining fuel is dispensed only through the slow flow valve. Slow flow begins when the volume delivered is equal to the preset sale volume minus (SFO X 0.05).

3.2.1 A0 - REQUEST FUELING POINT ID

FUNCTION CODE: A0

ADDRESS: Fx

FUNCTION: This command is used by a controller to detect an on-line fueling point, determine the dispenser type, and/or select appropriate commands for communication with the fueling point.

CONTROLLER COMMAND: Fx $\overline{Fx}$ A0 $\overline{A0}$

where Fx = Fueling point address
A0 = Function code

DISPENSER RESPONSE: A $\overline{A}$

where A = Fueling point ID (hex)

EXAMPLE COMMAND: F6 $\overline{F6}$ A0 $\overline{A0}$

Request fueling point 7 ID (address 06 Hex).

EXAMPLE RESPONSE: 99 $\overline{99}$

Fueling point 7 ID = 99.

3.2.2 B0 - REQUEST AUXILIARY FUELING POINT ID

FUNCTION CODE: B0

ADDRESS: Fx

FUNCTION: This command is used by a controller to acquire extended information in addition to the fueling point ID requested from the A0 command.

CONTROLLER COMMAND: Fx $\overline{Fx}$ B0 $\overline{B0}$

where Fx = Fueling point address
B0 = Function code

DISPENSER RESPONSE: A $\overline{A}$

where A = Auxiliary fueling point ID (hex)
01 indicates Premier with start button
02 indicates Premier with lift lever start

EXAMPLE COMMAND: F3 $\overline{F3}$ B0 $\overline{B0}$

Request fueling point 3 auxiliary ID (address 03 hex).

EXAMPLE RESPONSE: 01 $\overline{01}$

Fueling point auxiliary ID = 01.

3.2.3 A1 - REQUEST FUELING POINT DISPLAY DATA

FUNCTION CODE: A1

ADDRESS: Fx

FUNCTION: This command causes the fueling point to report the current sale data visible in the display. Decimal points are assumed in the following locations in the sale data:

Price/Unit Volume	P.PPP
Money amount	MMMM.MM
Volume amount	VVV.VVV

Exceptions:

The electronic blender and the variable blender will return three additional bytes before the status byte. These three bytes describe the total volume of product 1 dispensed in the current sale.

In Taiwan dispensers, decimal points are assumed in the following locations:

Price/Unit Volume	PPP.P
Money amount	MMMMMM.
Volume amount	VVVV.VV

One additional byte, the auxiliary dispenser status byte, is returned by TCS fueling points when configured for island authorization.

Three additional bytes are returned by Euro/UK and Blender/Bullet dispensers.

CONTROLLER COMMAND: Fx $\overline{Fx}$ A1 $\overline{A1}$

where Fx = Fueling point address
A1 = Function code

FUNCTION CODE: A1 (continued)

DISPENSER RESPONSE: A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$ G $\overline{G}$ H $\overline{H}$ I $\overline{I}$ [J $\overline{J}$ K $\overline{K}$ L $\overline{L}$]

where A = Price/Unit Vol. (lsb)
B = Price/Unit Vol. (msb)
C = Money (lsb)
D = Money (2sb)
E = Money (msb)
F = Volume (lsb)
G = Volume (2sb)
H = Volume (msb)
I = Fueling point status byte
or electronic. and variable
blenders prod. 1 vol (lsb)
[J] = 00 Hex
or Auxiliary dispenser status byte
or UK Blender/S.A. Bullet prod. ID
or electronic and variable blenders
prod. 1 vol 2sb)
[K] = 1/2 Pence indicator
or electronic and variable blenders
prod. 1 vol (msb)
[L] = 00 Hex
or electronic and variable blenders
l status byte

EXAMPLE COMMAND: F2 $\overline{F2}$ A1 $\overline{A1}$

Request fueling point 3 (address 02 Hex) display data.
Fueling point 3 is a TCS dispenser.

EXAMPLE RESPONSE: 29 $\overline{29}$ 11 $\overline{11}$ 19 $\overline{19}$ 16 $\overline{16}$ 00 $\overline{00}$ 37 $\overline{37}$ 43 $\overline{43}$ 01 $\overline{01}$

20 $\overline{20}$

FUNCTION CODE: A1 (continued)

Currently displayed sale data is:
Price 1.129
Money 0016.19
Volume 014.337

The dispenser is idle.

EXAMPLE COMMAND: F2 F2 A1 A1

Request fueling point 3 (address 02 Hex) display data.
Fueling point 3 is an electronic blend dispenser.

EXAMPLE RESPONSE: 29 29 11 11 19 19 16 16 00 00 37 37 43 43 01 01

50 50 71 71 00 00 20 20

Currently displayed sale data is:
Price 1.129
Money 0016.19
Volume 014.337

The volume of product 1 delivered is 007.150 units.
The dispenser is idle.

3.2.4 A2 - REQUEST FUELING POINT STATUS

FUNCTION CODE: A2

ADDRESS: Fx

FUNCTION: This command requests the fueling point to return its current status.

Function code A2 is used to determine the fueling point status, or to allow F8 dispensers which are not addressed to perform a display refresh cycle.

Exceptions:

One additional byte, the auxiliary dispenser status byte, is returned by TCS fueling points when configured for island authorization.

Taiwan dispensers will return an error status byte rather than the normal fueling point status if an error condition is detected. The error status can be cleared with an A7 command. Defined error status bytes are:

13 pulser error
14 maximum number of bad sales error
18 battery test error

For a Blender/Bullet multiproduct dispenser, this command also specifies the fuel price per unit volume for the high, low, and blended grades, and requests the fueling point to return the current status and selected fuel grade. In effect, this code combines the Fx A2, AUX A3, and AUX A1 codes into one command. Seven additional bytes are included in the controller command, and one additional byte is returned in the response.

```
FUNCTION
CODE:      A2 (continued)

CONTROLLER
COMMAND:   Fx Fx A2 A2 [ A A B B C C D D E E F F G G ]

              where Fx = Fueling point address
                    A2 = Function code
                   [A] = Preset Product
                         AB = Low grade
                         AC = Blended grade
                         AD = High grade
                         AE = No preset
                   [B] = High Grade Price/Unit Vol. (lsb)
                   [C] = High Grade Price/Unit Vol. (msb)
                   [D] = Blended Grade Price/Unit Vol. (lsb)
                   [E] = Blended Grade Price/Unit Vol. (msb)
                   [F] = Low Grade Price/Unit Vol. (lsb)
                   [G] = Low Grade Price/Unit Vol. (msb)

DISPENSER
RESPONSE:  A A [ B B ]

           where A = Fueling point status byte
                [B]= Auxiliary dispenser status byte
                       or Product identification byte

EXAMPLE
COMMAND:   F3 F3 A2 A2

           Request fueling point 4 (address 03 Hex) status.

EXAMPLE
RESPONSE   20 20

           Fueling point 4 is idle.
```

3.2.5 A3 - HALT SALE AND TURN VALVES OFF

FUNCTION CODE: A3

ADDRESS: Fx or ED

FUNCTION: This command halts a fueling point with a sale in progress. A halted fueling point turns off its pump motor; another fueling point may also have the motor turned on. All halted fueling points will turn off their valves and stop fuel flow. A sale may be continued or terminated after a halt. This function code is also used with the ED address to halt all fueling points.

Exceptions:

An additional auxiliary dispenser status byte is returned by TCS fueling points when configured for island authorization.

An additional product grade identification byte is returned by Blender/Bullet multiproduct dispensers.

CONTROLLER COMMAND: Fx $\overline{Fx}$ A3 $\overline{A3}$
or

ED $\overline{ED}$ A3 $\overline{A3}$

where Fx = Fueling point address
ED = All fueling points
A3 = Function code

DISPENSER RESPONSE: A $\overline{A}$ [B $\overline{B}$]

where A = Fueling point status byte
[B] = Auxiliary dispenser status byte or Product identification byte

FUNCTION CODE: A3 (continued)

EXAMPLE COMMAND: F7 $\overline{F7}$ A3 $\overline{A3}$

Halt fueling point 8 (address 07 Hex).

EXAMPLE RESPONSE: 98 $\overline{98}$

Halting fueling point 8.

3.2.6 A4 - RESUME SALE AND TURN VALVES ON

FUNCTION CODE: A4

ADDRESS: Fx

FUNCTION: This command causes a halted fueling point to resume a sale in progress when conditions allow, turn on the valves, and turn on the motor if it had been turned off by a halt.

Exceptions:

An additional auxiliary dispenser status byte is returned by TCS fueling points when configured for island authorization.

An additional product grade identification byte is returned by Blender/Bullet multiproduct dispensers.

CONTROLLER COMMAND: Fx $\overline{Fx}$ A4 $\overline{A4}$

where Fx = Fueling point address
A4 = Function code

DISPENSER RESPONSE: A $\overline{A}$ [B $\overline{B}$]

where A = Fueling point status byte
[B] = Auxiliary dispenser status byte or Product identification byte

EXAMPLE COMMAND: F2 $\overline{F2}$ A4 $\overline{A4}$

Resume fueling point 3 (address 02 Hex).

EXAMPLE RESPONSE: D0 $\overline{D0}$

Resuming fueling point 3.

3.2.7 A5 - AUTHORIZE FUELING POINT

FUNCTION CODE: A5

ADDRESS: Fx

FUNCTION: This command authorizes a fueling point for a sale and sends sale initiation parameters. A fueling point will accept authorization only while a hose is activated. A return status of 90 indicates that fueling point authorization was accepted. Decimal points are assumed in the following locations in the sale data:

Price/Unit Volume	P.PPP
Money amount	MMMM.MM
Volume amount	VVV.VVV

Exceptions:

Mechanical dispensers use the money amount as the maximum sale limit; electronic dispensers use the volume amount as the maximum sale limit.

Three additional bytes are sent in a command intended for Euro/UK dispensers.

Three additional bytes are sent in a command intended for Blender/Bullet multiproduct dispensers, and one additional product grade identification byte is returned by these dispensers.

One additional blend byte is sent in a command intended for variable blender dispensers, and one additional blend authorization byte is returned by these dispensers. A product 1 blend percentage of 100% is indicated by a blend value of A0H; a nonblended hose is indicated by a blend value of B0H.

In group II dispensers, Bits 7 and 6 in command byte J indicate the number bad sales (range 0-3) to allow before the dispenser locks up. A zero value for either variable indicates unlimited errors are allowed

FUNCTION CODE: A5 (continued)

(no error detection performed). Bits 5 through 0 in this byte specify the number of pulser errors (range 0-31) allowed before a sale is terminated as a bad sale.

While most controller versions use the value C5, controllers for some countries use other values. The value C5 hex (11000101 binary) indicates that 5 pulser errors will terminate a sale and 3 successive bad sales will require a manual dispenser reset.

An additional auxiliary dispenser status byte is returned by TCS dispensers when configured for island authorization.

UDC and 262 dispensers will not accept an A5 command if the fueling point handle has been raised and the fueling point display shows a price different from that sent in the A5 command. Non-Stand Alone F8 dispensers will accept and use the values sent by the A5 command.

If the A5 command is erroneously sent after a sale has started on a fueling point using the 38-F8 computer board, the maximum delivery counter may be reset to the amount specified in the A5 command, causing the sale to overrun by the amount dispensed before the command was received. For example, if A5 is received after $0.13 is dispensed, the sale may overrun the amount specified in the command by $0.13.

FUNCTION CODE: A5 (continued)

CONTROLLER COMMAND: Fx $\overline{Fx}$ A5 $\overline{A5}$ A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$ G $\overline{G}$ H $\overline{H}$ I $\overline{I}$

[J $\overline{J}$ K $\overline{K}$ L $\overline{L}$]

where Fx = Fueling point address
A5 = Function code
A = Slow Flow Offset
B = Price/Unit Vol. (lsb)
C = Price/Unit Vol. (msb
D = Maximum delivery - Money (lsb)
E = Maximum delivery - Money (2sb)
F = Maximum delivery - Money (msb)
G = Maximum delivery - Volume (lsb)
H = Maximum delivery - Volume (2sb)
I = Maximum delivery - Volume (msb)
[J] = Product 1 blend percentage (variable blender) or # Allowable errors & bad sales (other dispenser types)
[K] = 00H
[L] = 00H

DISPENSER RESPONSE: A $\overline{A}$ [B $\overline{B}$]

where A = Fueling point status byte
[B] = Auxiliary dispenser status byte or Product identification byte or Blend authorization status:
80 - authorized
81 - not authorized, price mismatch
82 - not authorized, blend % mismatch

FUNCTION CODE: A5 (continued)

EXAMPLE COMMAND: F3 F3 A5 A5 05 05 19 19 10 10 97 97 64 64 05 05

33 33 44 44 55 55

Authorize fueling point 4 (address 03 Hex) for a sale using the following values:

slow flow offset	05
fuel price	1.019
maximum money limit	564.97
maximum volume limit	554.433

EXAMPLE RESPONSE: 90 90

Fueling point 4 has been authorized.

EXAMPLE COMMAND: F3 F3 A5 A5 05 05 19 19 10 10 97 97 64 64 05 05

33 33 44 44 55 55 60 60

Authorize variable blender fueling point 4 (address 03 Hex) for a sale using the following values:

slow flow offset	05
fuel price	1.019
maximum money limit	564.97
maximum volume limit	554.433
product 1 blend %	60

EXAMPLE RESPONSE: 90 90 80 80

Fueling point 4 has been authorized for the blend value specified.

3.2.8 B5 - AUTHORIZE FUELING POINT

FUNCTION CODE: B5

ADDRESS: Fx

FUNCTION: This command authorizes a fueling point for a sale and sends sale initiation parameters. A fueling point will accept authorization only while a hose is activated. A return status of 90 indicates that fueling point authorization was accepted. The dispensers currently use the volume maximum delivery field exclusively. Future versions may use the money maximum delivery field, therefore it is recommended that both fields reflect the desired maximum delivery.

Exceptions:

In Taiwan dispensers, decimal points are assumed in the following locations:

Price/Unit Volume	PPP.P
Money amount	MMMMMM.
Volume amount	VVVV.VV

The 262 (F8 computer board) will limit the volume maximum delivery to 999.90 units of volume.

CONTROLLER COMMAND: Fx $\overline{Fx}$ B5 $\overline{B5}$ A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$ G $\overline{G}$ H $\overline{H}$ I $\overline{I}$

where Fx = Fueling point address
B5 = Function code
A = Slow Flow Offset
B = Price/Unit Vol. (lsb)
C = Price/Unit Vol. (msb)
D = Maximum delivery - Money (lsb)
E = Maximum delivery - Money (2sb)
F = Maximum delivery - Money (msb)
G = Maximum delivery - Volume (lsb)
H = Maximum delivery - Volume (2sb)
I = Maximum delivery - Volume (msb)

FUNCTION CODE: B5 (continued)

DISPENSER RESPONSE: A $\overline{A}$

where A = Fueling point status byte

EXAMPLE COMMAND: F3 $\overline{F3}$ B5 $\overline{B5}$ 05 $\overline{05}$ 19 $\overline{19}$ 10 $\overline{10}$ 97 $\overline{97}$ 64 $\overline{64}$ 05 $\overline{05}$

33 $\overline{33}$ 44 $\overline{44}$ 55 $\overline{55}$

Authorize fueling point 4 (address 03 Hex), which is a Taiwan dispenser, for a sale using the following values:

slow flow offset	05
fuel price	101.9
maximum money limit	564.97
maximum volume limit	5544.33

EXAMPLE RESPONSE: 90 $\overline{90}$

Fueling point 4 (address 03 Hex) has been authorized.

3.2.9 A6 - SEND DATA FOR FUELING POINT MAIN DISPLAYS

FUNCTION CODE: A6

ADDRESS: Fx

FUNCTION: This command is used to send data for the main displays to a fueling point.

When the fueling point is uninitialized (status 2F), the dispenser is initialized, sale data (money, volume, and price) for the current or last sale is sent, and status 20 is returned.

When the fueling point has already been initialized (status 20, 24, A0, or A1) and the fueling point is programmed to allow a price change with the handle up, sale data (money, volume, and price) for the current or last sale is sent, and the status is left unchanged.

Decimal points are assumed in the following locations:

Price/Unit Volume	P.PPP
Money amount	MMMM.MM
Volume amount	VVV.VVV

Exceptions:

Three additional bytes are sent in the command by Euro/UK dispensers.

Three additional bytes are sent in the command by Blender/Bullet dispensers, and one additional product grade identification byte is returned.

Only 262 dispensers use the price sent with this command for sales; TCS dispensers use instead the price sent with a Cx A3 command.

The 262 (F8 computer board) will limit the volume maximum delivery to 999.90 units of volume.

FUNCTION CODE: A6 (continued)

In Taiwan dispensers, decimal points are assumed in the following locations:

```
                Price/Unit Volume  PPP.P
                Money amount   MMMMMM.
                Volume amount  VVVV.VV
```

The Taiwan 262 (F8) limits the money display to five digits.

An additional auxiliary dispenser status byte is returned by TCS dispensers when configured for island authorization.

CONTROLLER COMMAND: Fx $\overline{Fx}$ A6 $\overline{A6}$ A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$ G $\overline{G}$ H $\overline{H}$

[I $\overline{I}$ J $\overline{J}$ K $\overline{K}$]

where Fx = Fueling point address
A6 = Function Code
A = Price/Unit Vol. (lsb)
B = Price/Unit Vol. (msb)
C = Money (lsb)
D = Money (2sb)
E = Money (msb)
F = Volume (lsb)
G = Volume (2sb)
H = Volume (msb)
[I] = 00H
[J] = 1/2 Pence indicator
[K] = 00H

DISPENSER RESPONSE: A $\overline{A}$ [B B]

where A = Fueling point status byte
[B] = Auxiliary dispenser status byte
or Product identification byte

FUNCTION CODE: A6 (continued)

EXAMPLE COMMAND:

F3	F3	A6	A6	19	19	10	10	77	77	88	88	09	09				
34	34	03	03	97	97												

Send initial data for main price displays on fueling point 4 (address 03 Hex) as follows:

fuel price	1.019
money	0988.77
volume	970.334

EXAMPLE RESPONSE:

20	20

Fueling point 4 initialized.

3.2.10 A7 - RESET FUELING POINT

FUNCTION CODE: A7

ADDRESS: Fx

FUNCTION: This command causes a fueling point reset, equivalent to powering down the dispenser then powering up again.

Exceptions:

In a UDC dispenser, this command will cause an active sale to be terminated, but will have no effect if no sale is in progress.

In a non-Stand Alone F8 dispenser, this command can be used to terminate a sale.

In a Taiwan dispenser, this command is also used to clear diagnostic error conditions.

This command should not be used with a 262 32-F8 dispenser.

CONTROLLER COMMAND: Fx $\overline{Fx}$ A7 $\overline{A7}$

where Fx = Fueling point address
A7 = Function Code

DISPENSER RESPONSE: The fueling point does not respond to this command.

EXAMPLE COMMAND: F2 $\overline{F2}$ A7 $\overline{A7}$

Reset fueling point 3 (address 02 Hex).

EXAMPLE RESPONSE: (No response.)

3.2.11 A9 - REQUEST SINGLE-PRODUCT STAND ALONE FUELING POINT TOTALS

FUNCTION CODE: A9

ADDRESS: Fx

FUNCTION: This command requests a single-product stand alone dispenser to return volume and money totals. If the dispenser is idle (status 20), the fueling point will respond to the command by returning four bytes for volume totals and four bytes for money totals, followed by a status byte. If not idle, the dispenser will return only a status byte. Decimal points are assumed in the following locations:

Money amount MMMMMM.MM
Volume amount VVVVV.VVV

Exceptions:

In Taiwan dispensers, decimal points are assumed in the following locations:

Money amount MMMMMMMM.
Volume amount VVVVVV.VV

In Blender/Bullet dispensers, the volume and money totals returned contain combined sales totals for all products.

CONTROLLER COMMAND: Fx $\overline{Fx}$ A9 $\overline{A9}$

where Fx = Fueling point address
A9 = Function code

DISPENSER RESPONSE: A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$ G $\overline{G}$ H $\overline{H}$

I $\overline{I}$ J $\overline{J}$ K $\overline{K}$ L $\overline{L}$ M $\overline{M}$ N $\overline{N}$ O $\overline{O}$ P $\overline{P}$ Q $\overline{Q}$

```
FUNCTION
CODE:       A9 (continued)

               where A = Volume byte 1 (LSB)
                     B = Volume byte 2
                     C = Volume byte 3
                     D = Volume byte 4 (MSB)
                     E = Money byte 1 (LSB)
                     F = Money byte 2
                     G = Money byte 3
                     H = Money byte 4 (MSB)
                   I-P = 0
                     Q = Fueling point status byte

EXAMPLE                __    __
COMMAND:    F8 F8 A9 A9

            Request totals for fueling point 9 (address 08 Hex).

EXAMPLE                __    __    __    __    __    __    __    __
RESPONSE:   22 22 33 33 44 44 55 55 66 66 77 77 88 88 09 09

            __    __    __    __    __    __    __    __    __    __
            00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

            __
            20 20

            Totals for fueling point 9 are:
              volume                55443.322
              money                 098877.66

            The fueling point is idle.

EXAMPLE                __    __
COMMAND:    F5 F5 A9 A9

            Request totals for fueling point 6 (address 05 Hex).

EXAMPLE                __
RESPONSE:   F0 F0

            The fueling point is not idle.
```

3.2.12 A9 - REQUEST MULTI-PRODUCT STAND ALONE FUELING POINT HOSE TOTALS

FUNCTION CODE: A9

ADDRESS: Fx

FUNCTION: This command requests a multi-product stand alone dispenser to return volume and money totals for four hoses. The command must specify running or shift totals, for either cash or credit sales.

If the dispenser is idle (status 20), the multi-product stand alone responds to this command by returning five bytes for volume and five bytes for money for each of the four possible hoses on the dispenser. Although four blocks of sale data are transmitted, only blocks for which corresponding hoses exist will contain significant data. If not idle, the dispenser will return only a status byte.

Decimal points are assumed in the following locations:

Money amount	MMMMMMMM.MM
Volume amount	VVVVVVV.VVV

Exceptions:

An additional auxiliary dispenser status byte is returned by TCS dispensers when configured for island authorization.

In Taiwan dispensers, decimal points are assumed in the following locations:

Money amount	MMMMMMMMMM.
Volume amount	VVVVVVVV.VV

A variable blend dispenser can return all hose totals, single hose totals, or blend meter totals, depending totals are requested, eight blocks of volume/money totals are returned. When single hose totals are requested, one block of volume/money totals is

FUNCTION CODE: A9 (continued)

returned. When blend meter totals are requested, two blocks of volume totals are returned.

CONTROLLER COMMAND: Fx $\overline{Fx}$ A9 $\overline{A9}$ A $\overline{A}$

where Fx = Stand-alone fueling point address
A9 = Function code
A = Type of totals requested:

TOTALS REQ. CONTROL BYTE

BIT	7	6	5	4	3	2	1	0
								=0 running totals
								=1 shift totals
					hose number 0-7 selected			
					hoses 1-8			
					=0 cash			
					=1 credit			
					=0			

0 0 - all hose totals
0 1 - single hose totals
1 0 - blend meter totals

DISPENSER RESPONSE: A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ [F $\overline{F}$]

where A = Fueling Position 1 Volume/Money
B = Fueling Position 2 Volume/Money
C = Fueling Position 3 Volume/Mone
D = Fueling Position 4 Volume/Money
E = Fueling point status byte
[F] = Auxiliary dispenser status byte

Each Volume/Money total will be in the form:

V1 $\overline{V1}$ V2 $\overline{V2}$ V3 $\overline{V3}$ V4 $\overline{V4}$ V5 $\overline{V5}$

M1 $\overline{M1}$ M2 $\overline{M2}$ M3 $\overline{M3}$ M4 $\overline{M4}$ M5 $\overline{M5}$

FUNCTION CODE: A9 (continued)

where V1-V5 = volume bytes 1 - 5 (lsb-msb)
and M1-M5 = money bytes 1 - 5 (lsb-msb)

Variable blender response for all hose totals:

A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$ G $\overline{G}$ H $\overline{H}$ I $\overline{I}$ [J $\overline{J}$]

where A = Fueling Position 1 Volume/Money
B = Fueling Position 2 Volume/Money
C = Fueling Position 3 Volume/Money
D = Fueling Position 4 Volume/Money
E = Fueling Position 5 Volume/Money
F = Fueling Position 6 Volume/Money
G = Fueling Position 7 Volume/Money
H = Fueling Position 8 Volume/Money
I = Fueling point status byte
[J] = Auxiliary dispenser status byte

Variable blender response for single hose totals:

A $\overline{A}$ B $\overline{B}$ [C $\overline{C}$]

where A = Selected hose 1 Volume/Money
B = Fueling point status byte
[C] = Auxiliary dispenser status byte

Variable blender response for blend meter totals:

A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ [D $\overline{D}$]

where A = Blend meter 1 volume
B = Blend meter 2 volume
C = Fueling point status byte
[D] = Auxiliary dispenser status byte

Each volume total will be in the form:

V1 $\overline{V1}$ V2 $\overline{V2}$ V3 $\overline{V3}$ V4 $\overline{V4}$ V5 $\overline{V5}$

FUNCTION CODE: A9 (continued)

EXAMPLE COMMAND: F6 F6 A9 A9 01 01

Request fueling point 7 (address 06 Hex) cash shift totals.

EXAMPLE RESPONSE: 90 90 78 78 56 56 34 34 12 12 21 21 43 43 65 65

87 87 09 09 55 55 44 44 33 33 22 22 11 11 00 00

99 99 88 88 77 77 06 06 66 66 77 77 88 88 99 99

00 00 11 11 22 22 33 33 14 14 00 00 00 00 50 50

00 00 00 00 00 00 00 00 05 05 00 00 00 00 00 00

20 20

Fueling point 7 cash shift totals are:
hose 1 volume 1234567.890
hose 1 money 09876543.21
hose 2 volume 1122334.455
hose 2 money 06778899.00
hose 3 volume 0099887.766
hose 3 money 00143322.11
hose 4 volume 0000005.000
hose 4 money 00000005.00
The fueling point is idle.

EXAMPLE: COMMAND: F6 F6 A9 A9 01 01

FUNCTION CODE: A9 (continued)

Request variable blender fueling point 7 (address 06 Hex) cash shift totals.

EXAMPLE RESPONSE:

90 $\overline{90}$ 78 $\overline{78}$ 56 $\overline{56}$ 34 $\overline{34}$ 12 $\overline{12}$ 21 $\overline{21}$ 43 $\overline{43}$ 65 $\overline{65}$

87 $\overline{87}$ 09 $\overline{09}$ 55 $\overline{55}$ 44 $\overline{44}$ 33 $\overline{33}$ 22 $\overline{22}$ 11 $\overline{11}$ 00 $\overline{00}$

99 $\overline{99}$ 88 $\overline{88}$ 77 $\overline{77}$ 06 $\overline{06}$ 66 $\overline{66}$ 77 $\overline{77}$ 88 $\overline{88}$ 99 $\overline{99}$

00 $\overline{00}$ 11 $\overline{11}$ 22 $\overline{22}$ 33 $\overline{33}$ 14 $\overline{14}$ 00 $\overline{00}$ 00 $\overline{00}$ 50 $\overline{50}$

00 $\overline{00}$ 00 $\overline{00}$ 00 $\overline{00}$ 00 $\overline{00}$ 05 $\overline{05}$ 00 $\overline{00}$ 00 $\overline{00}$ 00 $\overline{00}$

12 $\overline{12}$ 23 $\overline{23}$ 34 $\overline{34}$ 45 $\overline{45}$ 56 $\overline{56}$ 67 $\overline{67}$ 78 $\overline{78}$ 89 $\overline{89}$

90 $\overline{90}$ 01 $\overline{01}$ 09 $\overline{09}$ 98 $\overline{98}$ 87 $\overline{87}$ 76 $\overline{76}$ 65 $\overline{65}$ 54 $\overline{54}$

43 $\overline{43}$ 32 $\overline{32}$ 21 $\overline{21}$ 10 $\overline{10}$ 29 $\overline{29}$ 38 $\overline{38}$ 47 $\overline{47}$ 56 $\overline{56}$

65 $\overline{65}$ 74 $\overline{74}$ 83 $\overline{83}$ 92 $\overline{92}$ 01 $\overline{01}$ 13 $\overline{13}$ 14 $\overline{14}$ 15 $\overline{15}$

16 $\overline{16}$ 17 $\overline{17}$ 18 $\overline{18}$ 19 $\overline{19}$ 20 $\overline{20}$ 21 $\overline{21}$ 22 $\overline{22}$ 23 $\overline{23}$

20 $\overline{20}$

Fueling point 7 cash shift totals are:

hose 1 volume	1234567.890
hose 1 money	09876543.21
hose 2 volume	1122334.455
hose 2 money	06778899.00
hose 3 volume	0099887.766
hose 3 money	00143322.11
hose 4 volume	0000005.000
hose 4 money	00000005.00
hose 5 volume	5645342.312
hose 5 money	01908978.67
hose 6 volume	6576879.809
hose 6 money	10213243.54
hose 7 volume	6556473.829

FUNCTION CODE: A9 (continued)

hose 7 money	13019283.74
hose 8 volume	1817161.514

```
            hose 8 money          23222120.19

            The fueling point is idle.
```

EXAMPLE
COMMAND: F6 $\overline{F6}$ A9 $\overline{A9}$ 49 $\overline{49}$

Request variable blender fueling point 7 (address 06 Hex) cash shift totals for hose 5.

EXAMPLE
RESPONSE: 12 $\overline{12}$ 23 $\overline{23}$ 34 $\overline{34}$ 45 $\overline{45}$ 56 $\overline{56}$ 67 $\overline{67}$ 78 $\overline{78}$ 89 $\overline{89}$

90 $\overline{90}$ 01 $\overline{01}$ 20 $\overline{20}$

```
            Fueling point 7 cash shift totals for hose 5 are:
            hose 6 volume         5645342.312
            hose 6 money          01908978.67
            The fueling point is idle.
```

EXAMPLE
COMMAND: F6 $\overline{F6}$ A9 $\overline{A9}$ 80 $\overline{80}$

Request variable blender fueling point 7 (address 06 Hex) blend meter running totals.

EXAMPLE
RESPONSE: 90 $\overline{90}$ 78 $\overline{78}$ 56 $\overline{56}$ 34 $\overline{34}$ 12 $\overline{12}$ 55 $\overline{55}$ 44 $\overline{44}$ 33 $\overline{33}$

22 $\overline{22}$ 11 $\overline{11}$ 20 $\overline{20}$

```
            Fueling point 7 blend meter totals are:
            tank 1 volume         1234567.890
            tank 2 volume         1122334.455
            The fueling point is idle.
```

3.2.13 AA - SET FUELING POINT DISPLAY CONTROL DATA

FUNCTION CODE: AA

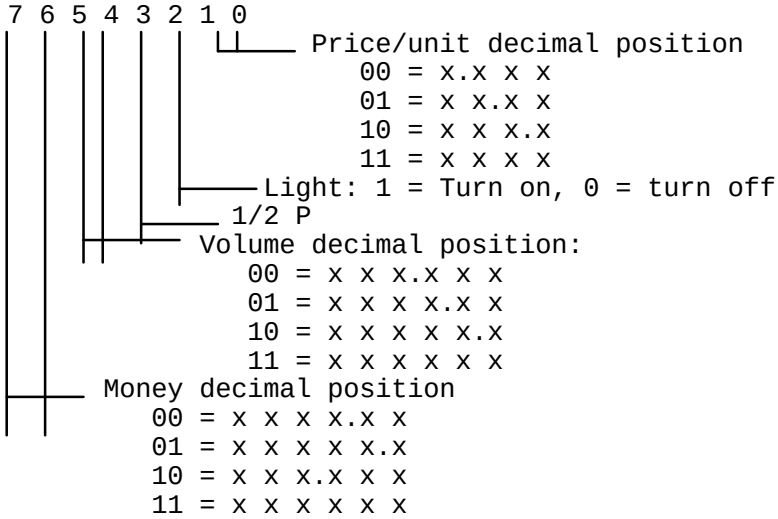
ADDRESS: Fx or ED

FUNCTION: This command is used to set the decimal position in the fueling point unit price, money, and volume displays, and turn the fueling point display light on or off. Currently, Display Board Assembly 416862 is used only in the International Model 262; this function is effective only on dispensers using this assembly.

CONTROLLER COMMAND: Fx $\overline{Fx}$ AA $\overline{AA}$ C $\overline{C}$

where Fx = Fueling point address
AA = Function code
C = Display control byte

The display control byte is bit-mapped, with thesignificance of each bit shown below.



FUNCTION CODE: AA (continued)

DISPENSER RESPONSE: The fueling point does not respond to this command.

EXAMPLE COMMAND: F3 F3 AA AA AB AB

Set the display control data for fueling point 4 (address 03 Hex) to:

money decimal	xxx.xxx
volume decimal	xxxxx.x
1/2 P	selected
light	off
price decimal	xxxx

EXAMPLE RESPONSE: (No response.)

3.2.14 AUX A1 - REQUEST ACTIVATED HOSE AND MOP

FUNCTION CODE: AUX A1

ADDRESS: Cx or Dx

FUNCTION: This command is used to determine which hose has been activated at a multihose fueling point. The dispenser or dispenser AUX board responds to this command by returning a byte indicating the selected handle and MOP.

After a hose has been activated, the AUX A1 command sent, and the response received at the console, the A5 or B5 Authorize Fueling Point command can be transmitted. If the pending approve is for a preset,the handle number returned in this response must match the preset product before the A5 or B5 command can be sent.

Exceptions:

On Group I multiproduct dispensers, this function selects the currently raised handle and locks out all other handle signals until an AUX A2 command is sent.

On Group II and III dispensers, handle interlocking is done at the dispenser independently of this command.

CONTROLLER COMMAND: $Dx\ \overline{Dx}\ A1\ \overline{A1}$
or
$Cx\ \overline{Cx}\ A1\ \overline{A1}$

where Dx = Fueling point address for Group I MMDs
Cx = Fueling point address for Group III dispensers
A1 = Function code

FUNCTION CODE: AUX A1 (continued)

DISPENSER RESPONSE: A A

where A is a bit-mapped number:
bit 7 = method of payment (0 = cash, 1 = credit)
bits 6-0 = handle number (0-8, 0 = no handle selected)

EXAMPLE COMMAND: D3 D3 A1 A1

Request activated hose and MOP for fueling point 4 (address 03 Hex).

EXAMPLE RESPONSE: 81 81

Hose 1 and credit are selected at fueling point 4.

3.2.15 AUX A2 - ACKNOWLEDGE DEACTIVATED HOSE

FUNCTION CODE: AUX A2

ADDRESS: Cx or Dx

FUNCTION: This command acknowledges hose deactivation, and unlocks any handles which were locked by an AUX A1 command.

CONTROLLER COMMAND:
Dx $\overline{Dx}$ A2 $\overline{A2}$
or
$\overline{Cx}$ Cx $\overline{A2}$ A2

where Dx = Fueling point address for Group I MMDs
Cx = Fueling point address for Group III dispensers
A2 = Function code

DISPENSE RESPONSE:
B0 $\overline{B0}$

where B0 = Acknowledge hose deactivation.

EXAMPLE COMMAND:
C6 $\overline{C6}$ A2 $\overline{A2}$

Acknowledge deactivated hose on fueling point 7 (address 06 Hex).

EXAMPLE RESPONSE:
B0 $\overline{B0}$

Hose deactivation acknowledged.

3.2.16 AUX A3 - SEND CASH PRICES FOR FUELING POINT AUXILIARY DISPLAYS

FUNCTION CODE: AUX A3

ADDRESS: Dx

FUNCTION: This command is used to send price data for all cash product price displays on a fueling point. TCS dispensers use the price sent with this command for sales.

A decimal point is assumed as shown: P.PPP

Exceptions:

In Taiwan dispensers, a decimal point is assumed as shown: PPP.P

CONTROLLER COMMAND: Dx $\overline{Dx}$ A3 $\overline{A3}$ A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$

where Dx = Fueling point address for Group I MMDs
A3 = Function code
A = #1 Price (msb)
B = Product #1 Price (lsb)
C = Product #2 Price (msb)
D = Product #2 Price (lsb)
E = Product #3 Price (msb)
F = Product #3 Price (lsb)

DISPENSER RESPONSE: B0 $\overline{B0}$

where B0 = Prices received.

```
FUNCTION
CODE:       AUX A3 (continued)

EXAMPLE
COMMAND:    DA DA A3 A3 12 12 34 34 56 56 78 78 90 90 12 12

            Send cash prices for fueling point 11 (address 0A Hex)
            as follows:
                  product 1   1.234
                  product 2   5.678
                  product 3   9.012

EXAMPLE
RESPONSE:   B0 B0

    Prices received.
```

3.2.17 AUX A3 - SEND CASH/CREDIT PRICES FOR FUELING POINT AUXILIARY DISPLAYS

FUNCTION CODE: AUX A3

ADDRESS: Cx

FUNCTION: This command is used to send price data for four cash/credit product price displays on a fueling point. A decimal point is assumed as shown: P.PPP

Exceptions:

In Taiwan dispensers, a decimal point is assumed as shown: PPP.P

A variable blender sends eight sets of cash/credit data rather than four, followed by the product 1 blend percentage. A product 1 blend percentage of 100% is indicated by a blend value of A0H; a nonblended hose is indicated by a blend value of B0H.

CONTROLLER COMMAND: Cx $\overline{Cx}$ A3 $\overline{A3}$ A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ [E $\overline{E}$ F $\overline{F}$ G $\overline{G}$ H $\overline{H}$ I $\overline{I}$

J $\overline{J}$ K $\overline{K}$ L $\overline{L}$ M $\overline{M}$ N $\overline{N}$ O $\overline{O}$ P $\overline{P}$]

where Cx = Fueling point address
A3 = Function code
A = Product #1 Cash/Credit prices
B = Product #2 Cash/Credit prices
C = #3 Cash/Credit prices
D = Product #4 Cash/Credit prices
[E]= Product #5 Cash/Credit prices
[F]= Product #6 Cash/Credit prices
[G]= Product #7 Cash/Credit prices
[H]= #8 Cash/Credit prices
[I]= Product #1 blend percentage
[J]= Product #1 blend percentage
[K]= #1 blend percentage
[L]= Product #1 blend percentage
[M]= Product #1 blend percentage

FUNCTION CODE: AUX A3 (continued)

[N]= #1 blend percentage
[O]= Product #1 blend percentage
[P]= Product #1 blend percentage

Each Cash/Credit price is in the form:

C1 $\overline{C1}$ C2 $\overline{C2}$ K1 $\overline{K1}$ K2 $\overline{K2}$

where C1-C2 = cash bytes 1 - 2 (msb-lsb)
and K1-K2 = credit bytes 1 - 2 (msb-lsb)

DISPENSER RESPONSE: B0 $\overline{B0}$

where B0 = Prices received.

EXAMPLE COMMAND: C0 $\overline{C0}$ A3 $\overline{A3}$ 12 $\overline{12}$ 34 $\overline{34}$ 43 $\overline{43}$ 21 $\overline{21}$ 56 $\overline{56}$ 78 $\overline{78}$

87 $\overline{87}$ 65 $\overline{65}$ 90 $\overline{90}$ 12 $\overline{12}$ 21 $\overline{21}$ 09 $\overline{09}$ 12 $\overline{12}$ 34 $\overline{34}$

43 $\overline{43}$ 21 $\overline{21}$

Send cash/credit prices for fueling point 1 (address 00 Hex) as follows:

	cash	credit
product 1	1.234	4.321
product 2	5.678	8.765
product 3	9.012	2.109
product 4	1.234	4.321

EXAMPLE RESPONSE: B0 $\overline{B0}$

Prices received.

FUNCTION CODE: AUX A3

EXAMPLE COMMAND:

C0 C0 A3 A3 12 12 34 34 43 43 21 21 56 56 78 78

87 87 65 65 90 90 12 12 21 21 09 09 43 43 21 21

09 09 87 87 54 54 32 32 10 10 98 98 65 65 43 43

21 21 09 09 76 76 54 54 32 32 10 10 87 87 65 65

43 43 21 21 B0 B0 A0 A0 75 75 50 50 25 25 00 00

B0 B0 B0 B0

Send cash/credit prices and blend percentages for variable blender fueling point 1 (address 00 Hex) as follows:

	cash	credit
product 1	1.234	4.321
product 2	5.678	8.765
product 3	9.012	2.109
product 4	4.321	0.987
product 5	5.432	1.098
product 6	6.543	2.109
product 7	7.654	3.210
product 8	8.765	4.321

Product #1 = Nonblended hose
Product #2 = 100% blend
Product #3 = 75% blend
Product #4 = 50% blend
Product #5 = 25% blend
Product #6 = 0% blend
Product #7 = Nonblended hose
Product #8 = Nonblended hose

EXAMPLE RESPONSE: B0 B0

Information received.

3.2.18 AE - EXTENDED FUNCTION CODE PREFIX AE

The extended function code prefix AE is used when transmitting certain extended commands. All extended commands use the following general format.

Fx $\overline{Fx}$ AE $\overline{AE}$ A $\overline{A}$ [B $\overline{B}$ ... P $\overline{P}$]

where Fx = Fueling point address
AE = Extended function code prefix
A = Function code -
Upper nibble - command number (0-9)
Lower nibble - number of additional bytes (0-F) which follow
B-P = 1-15 data bytes (where required by the command)

The following sections describe function codes which use the AE prefix.

3.2.18.1 AE 01 - SET UDC METHOD OF PAYMENT AND HOSE

FUNCTION CODE: AE 01

ADDRESS: Fx

FUNCTION: This command sets the method of payment and hose for a sale at a fueling point on a UDC dispenser.

Exceptions:

An additional auxiliary dispenser status byte is returned by TCS dispensers when configured for island authorization.

CONTROLLER1 COMMAND: Fx $\overline{Fx}$ AE $\overline{AE}$ 01 $\overline{01}$ xy $\overline{xy}$

where Fx = Fueling point address
AE = Extended function code prefix
01 = Function code, where
0 = command code
1 = message length
xy = hexadecimal number:
x = method of payment
0 = Don't care
1 = Cash
2 = Credit
y = hose
0 = hose 1
1 = hose 2
2 = hose 3
3 = hose 4
8 = Don't care

DISPENSER RESPONSE: A $\overline{A}$ [B $\overline{B}$]

where A = Fueling point status byte
[B] = Auxiliary dispenser status byte

FUNCTION CODE: AE 01 (continued)

EXAMPLE COMMAND: F1 $\overline{F1}$ AE $\overline{AE}$ 01 $\overline{01}$ 11 $\overline{11}$

Set a sale for cash using hose 2 on fueling point 2 (address 01 Hex).

EXAMPLE
RESPONSE: 20 $\overline{20}$

MOP and hose accepted.

3.2.18.2 AE 10 - REQUEST FUELING POINT RESERVE

FUNCTION CODE: AE 10

ADDRESS: Fx

FUNCTION: This command requests a fueling point which is configured for island authorization to reserve itself for a sale initiated at the controller. When the fueling point has been reserved for the controller, another sale cannot be initiated at the fueling point until the fueling point is unreserved.

An additional auxiliary dispenser status byte is returned by TCS dispensers when configured for island authorization.

CONTROLLER COMMAND: Fx $\overline{Fx}$ AE $\overline{AE}$ 10 $\overline{10}$

where Fx = Fueling point address
AE = Extended function code prefix
10 = Function code, where
1 = command code
0 = message length

DISPENSER RESPONSE: A $\overline{A}$ B $\overline{B}$

where A = Fueling point status byte
B = Auxiliary dispenser status byte

EXAMPLE COMMAND: F3 $\overline{F3}$ AE $\overline{AE}$ 10 $\overline{10}$

Reserve fueling point 4 (address 03 Hex).

EXAMPLE RESPONSE: 20 $\overline{20}$

Fueling point reserved.

3.2.18.3 AE 20 - REQUEST FUELING POINT UNRESERVE

FUNCTION CODE: AE 20

ADDRESS: Fx

FUNCTION: This command requests a fueling point which is configured for island authorization to unreserve itself after it has been reserved for a sale by the controller. When the fueling point has been reserved for the controller, another sale cannot be initiated at the fueling point until the fueling point is unreserved.

An additional auxiliary dispenser status byte is returned by TCS dispensers when configured for island authorization.

CONTROLLER COMMAND: Fx $\overline{Fx}$ AE $\overline{AE}$ 20 $\overline{20}$

where Fx = Fueling point address
AE = Extended function code prefix
20 = Function code, where
2 = command code
0 = message length

DISPENSER RESPONSE: A $\overline{A}$ B $\overline{B}$

where A = Fueling point status byte
B = Auxiliary dispenser status byte

EXAMPLE COMMAND: F7 $\overline{F7}$ AE $\overline{AE}$ 20 $\overline{20}$

Unreserve fueling point 8 (address 07 Hex).

EXAMPLE RESPONSE: 20 $\overline{20}$
Fueling point unreserved.

3.2.18.4 AE 32 - SET UDC RETAIL/FLEET PRODUCT RESTRICTION

FUNCTION CODE: AE 32

ADDRESS: Fx

FUNCTION: This command sets Fleet or Retail product restricted operation, method of payment, and any combination of active products.

Exceptions:

An additional auxiliary dispenser status byte is returned by UDC dispensers when configured for island authorization.

Note: Product to hose assignments are handled by the controller.

CONTROLLER COMMAND: Fx $\overline{Fx}$ AE $\overline{AE}$ 32 $\overline{32}$ X $\overline{X}$ Y $\overline{Y}$

Where Fx = Fueling point address
AE = Extended function code prefix
32 = Function code where
3 = command code
2 = message length
X = T00000MM (binary number)
T = 1 - Fleet sale
= 0 - Retail sale

MM = 11 both MOP's activeE
= 01 MOP 1 active
= 10 MOP 2 active
Y = active products (binary number)
Y.0 = BIT 0 of Y = hose 1
Y.1 = BIT 1 of Y = hose 2
Y.2 = BIT 2 of Y = hose 3
Y.3 = BIT 3 of Y = hose 4
Y.4 = BIT 4 of Y = hose 5
Y.5 = BIT 5 of Y = hose 6

FUNCTION CODE: AE 32 (continued)

Y.6 = BIT 6 of Y = hose 7
Y.7 = BIT 7 of Y = hose 8

DISPENSER RESPONSE: A $\overline{A}$ [B $\overline{B}$]

where A = Fueling point status byte
[B] = Auxiliary dispenser status byte

EXAMPLE COMMAND: F1 $\overline{F1}$ AE $\overline{AE}$ 32 $\overline{32}$ 02 $\overline{02}$ 15 $\overline{15}$

X = 02H = 00000010B Y = 00010101B

Set a retail product restricted sale for credit using products 1,3, or 5 on fueling point 2 (address 01 Hex).

ANOTHER EXAMPLE COMMAND: FF $\overline{FF}$ AE $\overline{AE}$ 32 $\overline{32}$ 81 $\overline{81}$ 06 $\overline{06}$

X = 81H = 10000001B Y = 06H = 00001100B

Set a fleet product restricted sale for cash using products 3 or 4 on fueling point 16 (address 0F Hex).

EXAMPLE RESPONSE: 20 $\overline{20}$

Any valid dispenser status response aknowledges product restriction type, MOP and products accepted.

3.2.18.5 AE 46 - ALTER MAXIMUM DELIVERY SETTINGS DURING SALE

FUNCTION CODE: AE 46

ADDRESS: Fx

FUNCTION: This command alters maximum delivery settings which were previously set with the Fx A5 command and is only valid after a dispenser has been authorized with an Fx A5 command and a sale is in progress. This command can be used to increase or decrease the maximum allowable delivery settings.

EXCEPTIONS:
The dispenser must be in an active running state and must not have reached the maximum delivery specified by the previous Fx A5.

If an AE 46 command is utilized by the site controller, and the amount of fuel presently dispensing by the UDC is marginally close to the new AE 46 maximum delivery amount being sent to the UDC, the possibility of an overrun exists. These timing considerations must be accounted for during the implementation of this command.

CONTROLLER COMMAND: Fx $\overline{Fx}$ AE $\overline{AE}$ 46 $\overline{46}$ A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$

where Fx = Fueling point address
AE = Extended function code prefix
46 = Function code, where
4 = command code
6 = message length
A = Maximum delivery - money (1sb)
B = Maximum delivery - money (2sb)
C = Maximum delivery - money (msb)
D = Maximum delivery - volume (1sb)
E = Maximum delivery - volume (2sb)
F = Maximum delivery - volume (msb)

FUNCTION CODE: AE 46 (continued)

DISPENSER RESPONSE: A $\overline{A}$

where A = Sale money multiplication factor

EXAMPLE COMMAND: F3 $\overline{F3}$ AE $\overline{AE}$ 46 $\overline{46}$ 97 $\overline{97}$ 64 $\overline{64}$ 05 $\overline{05}$ 33 $\overline{33}$ 44 $\overline{44}$ 55 $\overline{55}$

Alter fueling position 4 (address 03 hex) for a sale using the following values

maximum money limit	564.97
maximum volume amount	554.433

EXAMPLE RESPONSE: F0 $\overline{F0}$

Command has been received.

3.2.18.6 AE 50 - REQUEST DISPLAY DATA FORMAT

FUNCTION CODE: AE 50

ADDRESS: Fx

FUNCTION: This command requests fueling point display data format information.

CONTROLLER COMMAND: Fx $\overline{Fx}$ AE $\overline{AE}$ 50 $\overline{50}$

where Fx = Fueling point address
AE = Extended function code prefix
50 = Function code, where
5 = command code
0 = message length

DISPENSER RESPONSE: A $\overline{A}$ B $\overline{B}$ C $\overline{C}$ D $\overline{D}$ E $\overline{E}$ F $\overline{F}$ G $\overline{G}$ H $\overline{H}$ I $\overline{I}$

J $\overline{J}$ K $\overline{K}$ L $\overline{L}$ M $\overline{M}$ N $\overline{N}$ O $\overline{O}$ P $\overline{P}$ Q $\overline{Q}$

where A = Sale money multiplication factor
B = Sale volume multiplication factor
C = Sale price multiplication factor
D = Totals money multiplication factor
E = Totals volume multiplication factor
F = IFSF money/decimal size
G = IFSF volume/decimal size
H = IFSF price/decimal size
I = IFSF price multiplier
J-P Null (0) for future use
Q = Dispenser status

EXAMPLE COMMAND: F0 $\overline{F0}$ AE $\overline{AE}$ 50 $\overline{50}$

Request display formats for fueling point 1 (address 00 hex)

FUNCTION CODE: AE 50 (continued)

EXAMPLE RESPONSE:

00 00 00 00 00 00 00 00 00 00 46 46

46 46 14 14 00 00 00 00 00 00 00 00

00 00 00 00 00 00 20 20

The value 46 in field (F) of the example response indicates that the money display is 6 digits in size, with the decimal point set after the 4th digit from the left. Or, the decimal point location is between the 4th and 5th digits.

Multiplication factors are used when the value to be displayed has more digits than the physical display. For example, if the money amount is comprised of 7 digits, and the display can show only 6 digits, the multiplication factor would be 01, indicating to the dispenser controller that the returned value (or value sent in response) is to be multiplied by a factor of 10 to obtain the correct value. In this case the least significant digit (normally 0) would be printed onto the dispenser dial plate, making it a seven digit display.

3.2.18.7 AE 61 - RETURN DISPENSER ERRORS

FUNCTION CODE: AE 61

ADDRESS: Fx

FUNCTION: This command requests return of dispenser errors and allows dispenser errors to be cleared.

Exceptions:
The dispenser must not be in an active running state.

CONTROLLER COMMAND: Fx $\overline{Fx}$ AE $\overline{AE}$ 61 $\overline{61}$ yx $\overline{yx}$

where Fx = Fueling point address
AE = Extended function code prefix
61 = Function code, where
6 = command code
1 = message length
yx 00 - return dispenser code
01 - clear dispenser error

DISPENSER RESPONSE: X $\overline{X}$ A $\overline{A}$

where X = 00 - no error
= error number (01H - 99H)
A = fueling point status word

Older equipment will not respond.

EXAMPLE COMMAND: F3 $\overline{F3}$ AE $\overline{AE}$ 61 $\overline{61}$ 00 $\overline{00}$

Request return of dispenser errors.

EXAMPLE RESPONSE: 31 $\overline{31}$ 20 $\overline{20}$

Dispenser returns error 31 and fueling point status is 20H.

3.2.19 AF - REQUEST ATTENDANT CONTROL KEY CODE

FUNCTION CODE: AF

ADDRESS: Fx

FUNCTION: This command requests an Attendant Control Keycode from a fueling point. When the fueling pointrequests approval from the controller, thecontroller will request an attendant control keycode. A hex encoded version of the attendant controlkey is supplied by a transmitter carried by theattendant, which signals a receiver in the fuelingpoint. The receiver passes on the encoded numberto the controller which decodes and compares thenumber to a list of valid numbers.

If a valid code is returned, the controller will authorize the fueling point for a sale. If no code is returned or an invalid code is returned, the fueling point will not be authorized.

Exceptions:

This function is used only in South Africa with specially equipped TCS and 262 dispensers. It is not currently available for use in any other country. See Tokheim South Africa Attendant Control Key document for more information.

CONTROLLER COMMAND: Fx $\overline{Fx}$ AF $\overline{AF}$

where Fx = Fueling point address
AF = Function code

DISPENSER RESPONSE: A $\overline{A}$ B $\overline{B}$ C $\overline{C}$

where A = Attendant control key code (lsb)
B = Attendant control key code (msb)
C = Dispenser status

FUNCTION CODE: AF (continued)

EXAMPLE COMMAND: F7 $\overline{F7}$ AF $\overline{AF}$

Request attendant control key code from fueling point 8 (address 07 hex)

EXAMPLE RESPONSE: 90 $\overline{90}$ 18 $\overline{18}$ A0 $\overline{A0}$

The encoded attendant control key is transmitted as 1890. Dispenser status is "fueling point idle."

APPENDIX A - EQUIPMENT CONFIGURATIONS

This appendix summarizes standard equipment configurations. Figures A-1 through A-3 show equipment used with Group I-III dispensers, respectively.

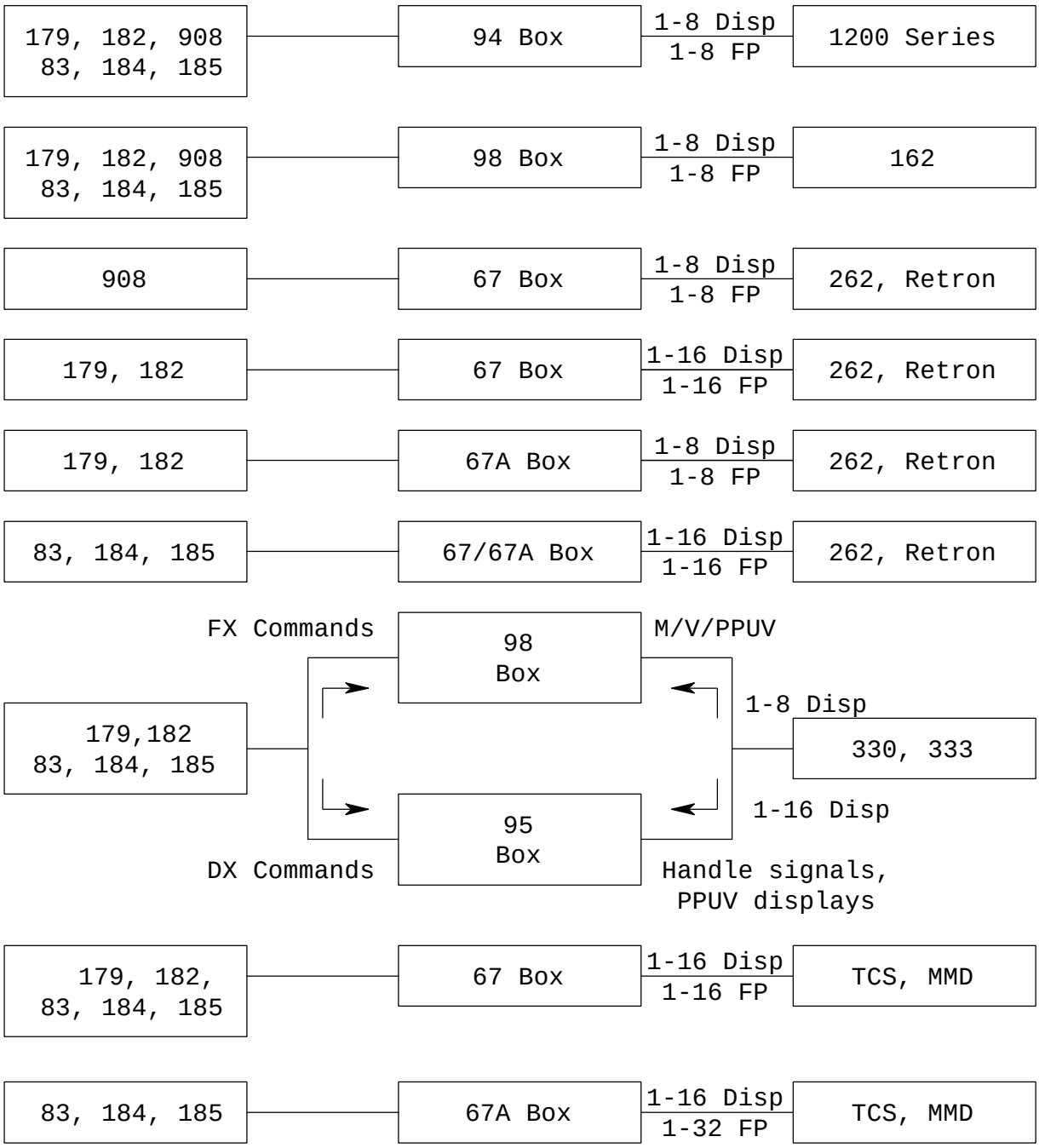


Figure A-1. Equipment Configurations - Group I Dispensers

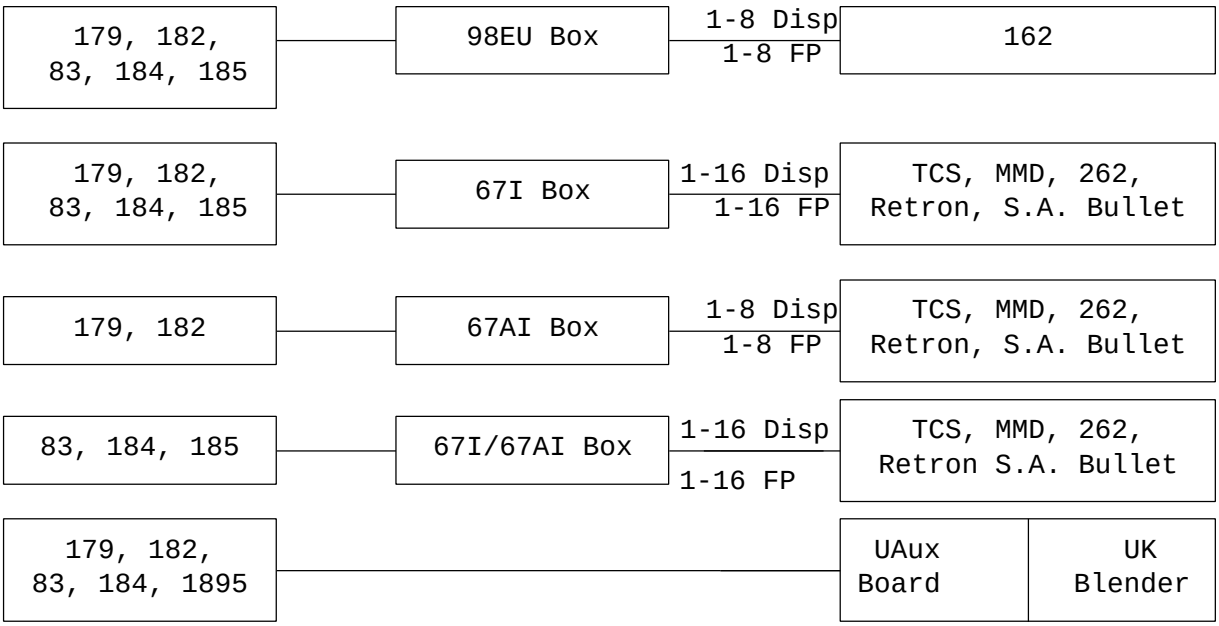


Figure A-2. Equipment Configurations - Group II Dispensers

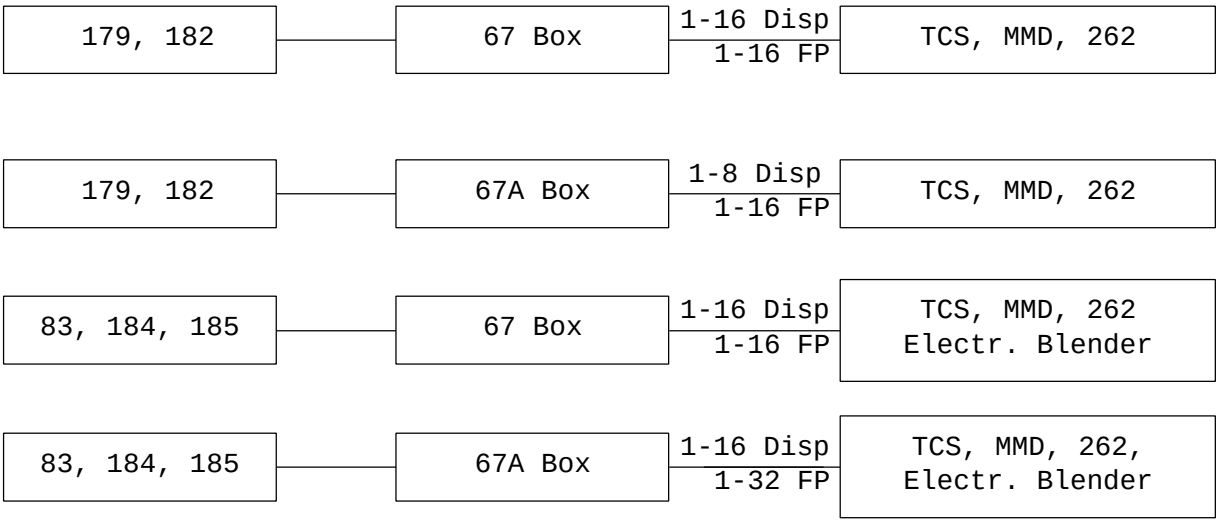


Figure A-3. Equipment Configurations - Group III Dispensers

APPENDIX B - DISPENSER CHARACTERISTICS

A dispenser is a physical device which may contain one or more logical devices called fueling points. A fueling point can offer a choice of products from one to eight hoses. Only one hose on a fueling point can be active at any time. All current Tokheim dispensers offer either one or two fueling points.

Tokheim fuel dispensers may operate as stand alone units or as remotes connected to a Tokheim controller. Communication characteristics of dispensers connected to a Tokheim controller are described in this appendix. Detailed information on operation and use of Tokheim dispensers can be found in the dispenser functional specifications, operator interface specifications, and customer manuals.

B.1 DISPENSER CLASSIFICATION

Tokheim dispensers are normally classified in dispenser series whose members share common hardware and software elements. For communication purposes, it is more useful to classify dispensers according to groups which communicate with Tokheim controllers in a similar manner. In terms of communication, dispensers are divided into three groups. Each group includes both domestic and international models. The three groups are listed in Figure B.1-1.

Group I	F8-based dispensers
Group II	European F8-based dispensers
Group III	UDC and TCS dispensers

Figure B.1-1. Dispenser Groups

B.2 DISPENSER IDENTIFICATION CODES

Each fueling point is programmed to return an identification code during communication with a controller. This code indicates the type of dispenser, the current programmed mode of operation, and the communication protocol used.

In many cases, a dispenser can be assigned one of several ID codes; this indicates that the same dispenser can communicate in any one of several possible ways, depending on the dispenser configuration and programming.

Figures B.2-1 through B.2-3 list the ID codes which can be returned by each dispenser.

Group I	ID
1200 Series Mechanical	9A (96*)
162 Series Electronic	97,9C,9B,2B
MMD Series 330/333	97,9C,9B,2B
TCS/MMD (Original MMD protocol)	98
262 Domestic	9D
262 International (Domestic operation)	99,29
Retron Domestic	98,9D,99

Group II	ID
Euro 162	9D
UK Blender	91
SA Bullet	94
Retron International	98,9D
262 International	9D,2D

* Dispensers using 17- F8 software return ID 96. Refer to Figure B.3-1 for more information.

Figure B.2-1. Group I and II Dispenser ID Codes

Group III	ID
Model 242/244	06
MMD Stand-Alone or TCS, nonstand alone operation	98
MMD Stand-Alone or TCS, one displayed price per hose, no price change with handle up	96
MMD Stand-Alone or TCS, one displayed price per hose, price change OK with handle up	36
MMD Stand-Alone or TCS, two displayed prices per hose, no price change with handle up	86
MMD Stand-Alone or TCS, two displayed prices per hose, price change OK with handle up	26
TCS, island authorization allowed, nonstand alone operation	98
TCS, island authorization allowed, one displayed price per hose, no price change with handle up	B5
TCS, island authorization allowed, one displayed price per hose, price change OK with handle up	55
TCS, island authorization allowed, two displayed prices per hose, no price change with handle up	A5
TCS, island authorization allowed, two displayed prices per hose, price change OK with handle up	45
262A, nonstand alone operation	98
262A, one displayed price per hose, no price change with handle up	99
262A, one displayed price per hose, price change OK with handle up	29
262A, two displayed prices per hose, no price change with handle up	86
262A, two displayed prices per hose, price change OK with handle up	26
Electronic Blender, nonstand alone operation	98
Electronic Blender, one displayed price per hose, no price change with handle up	90
Electronic Blender, one displayed price per hose, price change OK with handle up	30
Electronic Blender, two displayed prices per hose, no price change with handle up	80
Electronic Blender, two displayed prices per hose, price change OK with handle up	20

Figure B.2-2. Group III Dispenser ID Codes, Part 1 of 2

Group III	ID
Variable Blender, nonstand alone operation	9C
Variable Blender, one displayed price per hose, no price change with handle up	92
Variable Blender, one displayed price per hose, price change OK with handle up	32
Variable Blender, two displayed prices per hose, no price change with handle up	82
Variable Blender, two displayed prices per hose, price change OK with handle up	22

Figure B.2-3. Group III Dispenser ID Codes, Part 2 of 2

B.3 DISPENSER SOFTWARE RELEASES

Dispenser characteristics are largely controlled by the installed software, therefore the software release number is useful in determining expected dispenser operation.

Figures B.3-1 through B.3-4 describe each release of dispenser software, listing the dispensers which use the software, dispenser IDs which can be returned by dispensers using the software, and any known software problems.

SW#	ID	Group	Model	Release Date	Part #/ Vendor #	Description
1	9A	I	1200	1978	8-314951 MK14265	Original mechanical 3870.
2	9C	I	162/MM D	1978	12-314951 MK14357	Domestic electronic 3870. Doesn’t synch. display on A2 commands
3	*	I	1200	1981	17-314951 SL90497	Revised mechanical 3870. * Returns invalid double-talk for ID: 96-65 instead of 9A-65.
4	97	I	162/MM D	1981	18-314951 SL90498	Domestic electronic 3870 Doesn’t recognize handle while halted
5	9C	I	162/MM D	1982	29-314951 MK14716	Domestic electronic 3870 Software bug when PPU is under $1.00
6	9D*	I	262	1983	32-314951 MK17128	Domestic 262 (stand-alone) 3870. * Returns wrong ID of 9D instead of 99. Totals can be corrupted if an A7 reset command is received during a sale.
7	9B	I	162/MM D	1983	36-314951 SL90705	Domestic electronic 3870. Minor problem in manual mode. Includes the AA display control command
8	9B	I	162/MM D	1983	36-314951 SL90756 MK14773	Domestic electronic 3870. 36-manual mode problem fixed.
9	9B	I	162/MM D	1986	64-314951 MK14789	Domestic electronic 3870. A5 command blocked during FX status Liter/Gallon switch read only at power-up

Figure B.3-1. Dispenser Software Releases, Part 1

SW#	ID	Group	Model	Release Date	Part #/ Vendor #	Description
10	9A	I	1200	1986	68-314951 MK14793	Original mechanical 3870. Solves handle lock-up problem.
11	9D	II	Euro 162	1984	115-314950	European 94EU-98EU mechanical and electronic 3870 emulator EPROM. (2532)
12	99 9D	I, II	262/ INT/DOM	1983	141-314950	Int/Domestic 262 3870 emulator EPROM. A7 reset problem fixed. Switch-selectble Dom/Int protocol. US (Group I): 99 (not released) Int'l (Group II): 9D
13	98	I, II	Retron	____	_____ AM.22.57.01 AM.22.58.01	Retron dispenser EPROM Same ID for US and Internationa. Incorrect response to A9.
14	9D	I, II	Retron	1987	_____ AM.32.57.01 AM 32.58.01	Retron dispenser EPROM. Same ID for US and International Incorrect response to A9.
15	9D*	I, II	Retron	1988	_____ AM.03.26.07 AM 03.26.08	Retron dispenser EPROM. Same ID for US and International.
16	99 9D	I, II	Retron	1988	_____ AM.03.27.07 AM 03.27.08	Retron dispenser EPROM. US (Group I): 99 Int'l (Group II): 9D
17	91	II	UK Blender	____	_____	3870 emulator EPROM (2532) for UK blender UAUX board.
18	94	II	SA F8 Bullet	1983	_____	SA Bullet 3870 emulator EPROM (2732).
19	06	III	Spec UDC	1987	229-314950	Model 242/244 UDC EPROM.
20	98 96	I, III	1-MOP SA MMD	1987	234-314950	Domestic Stand-Alone MMD EPROM Selectable ID Non-SA MMD (Group I): 98 1-MOP SA MMD (Group III): 96

Figure B.3-2 Dispenser Software Releases, Part 2

SW#	ID	Group	Model	Release Date	Part #/ Vendor #	Description
21	98 96 86	I, III	2-MOP SA MMD Canada	———	235-314950	Canada Stand-Alone MMD EPROM. Selectable ID. Non-SA MMD (Group I): 98 1-MOP SA MMD (Group III): 96 2-MOP SA MMD (Group III): 86
22	98 96 86	I, III	2-MOP SA MMD	1987	248-314950	Domestic Stand-Alone MMD EPROM. Selectable ID. Non-SA MMD (Group I): 98 1-MOP SA MMD (Group III): 96 2-MOP SA MMD (Group III): 86
23	2B	I	162/MMD Flying J	1989	335-314950 DB.00.00.01	Domestic electronic 3870 emulator EPROM. Contains 267-program in 2732. Price change with handle up.
24	9D	II	Euro 162	1989	336-314950 DB.00.00.04	European 94EU-98EU mecahnical and electronic emulator EPROM. Contains 115-program in 2732.
26	98 99 86 29 26	I, III	262A	1989	344-314950 DY.00.00.04	Domestic 262A EPROM. Selectable ID. Non-SA MMD (Group I): 98 1-MOP (Group I): 99 or 29 2-MOP (Group III): 86 or 26
27	98 96 86 36 26 B5 A5 55 45*	I, III	TCS	1989	247-314950 AQ.02.01.0B	Domestic TCSA/MMD EPROM. Selectable ID. Non-SA MMD (Group I): 98 No Island Authorization Device: 1-MOP (Group III): 96 or 36 2-MOP (Group III): 86 or 26 With Island Authorization Device 1-MOP (Group III): B5 or 55 2-MOP (Group III): A5 or 45

Figure B.3-3 Dispenser Software Releases, Part3

SW#	ID	Group	Model	Release Date	Part #/ Vendor #	Description
28	98 96 86 36 26	III	TCS	1989	247-314950 BQ.02.01.0D	TCSA Kuwait EPROM. Selectable ID: See AQ.02.01.0B
29	9A	I	1200	1989	252-314950	Mechanical 3870.
30	29 2D	I, II	262 INT/DOM	1989	266-314950 DX.00.00.06	Int/Domestic 262 3870 emulator EPROM. Same as 141-, with price change with handle up US (Group I): 29 Int'l (Group II): 2D
31	98 99 86 29 26	I,III	262A	1989	337-314950 DX.00.00.06	262A Taiwan EPROM. Selectable ID: See DY.00.00.04
32	98 96 86 36 26	I, III	TCS	1989	338-314950 DP.00.00.03	TCSA Taiwan EPROM. Selectable ID: See AQ.02.01.0B
33	98 96 86 36 26	I, III	TCS	1989	357-314950 EE.02.01.0C	TCS SuperAmerica EPROM. Selectable ID: See AQ.02.01.0B
34	98 96 86 36 26	I, III	TCS	1989	358-314950 AQ.02.01.0E	Domestic TCS/MMD EPROM. Selectable ID: See AQ.02.01.0B
35	98 90 80 30 20	I, III	Electr Blend	1989	362-314950 EU.00.00.07	Domestic Electronic Blender EPROM Selectable ID. Non-SA MMD (Group I): 98 1-MOP (Group III): 90 or 30 2-MOP (Group III): 80 or 20

Figure B.3-4 Dispenser Software Releases, Part4

B.4 FUNCTION CODE CROSS-REFERENCE BY DISPENSER ID

Each dispenser recognizes and responds to a subset of the function codes described in this document. Figures B.4-1 through B.4-5 cross-reference use of each of the function codes described in this document by software version and dispenser ID code, for dispenser groups I to III.

Dispenser	ID												
TCS/MMD	98												
Retron	9D												
Retron	99												
Retron	98												
162/MMD	97												
162/MMD	9C												
162/MMD	9B												
162/MMD	2B												
1200	96												
1200	9A												
262 Dom	9D												
262 Dom	99												
262 Dom	29	99	9D	9A	96	2B	9B	9C	97	98	99	9D	98
Software				1			7						20,21,22,25
Release				10			8	2				14	26,27,28,31
Number	30	12	6	29	3	23	9	5	4	13	16	15	32,33,34,35
FX A0	*	*	*	*	*	*	*	*	*	*	*	*	*
FX A1	*	*	*	*	*	*	*	*	*	*	*	*	*
FX A2	*	*	*	*	*	*	*	*	*	*	*	*	*
FX A3	*	*	*	*	*	*	*	*	*	*	*	*	*
ED A3	*	*	*	*	*	*	*	*	*	*	*	*	*
FX A4	*	*	*	*	*	*	*	*	*	*	*	*	*
FX A5	*	*	*	*	*	*	*	*	*	*	*	*	*
FX A6	*	*	*	*	*	*	*	*	*	*	*	*	*
FX A7	*	*	*	*	*	*	*	*	*	*	*	*	*
FX A9 (1 prod)	*	*	*							*	*	*	
FX A9													*
DX A1						*	*	*	*				*
DX A2						*	*	*	*				*
DX A3						*	*	*	*				*

Figure B.4-1. Group I Dispenser Function Codes

Dispenser ID							
Euro 162	9D						
262 Int'l	9D						
262 Int'l	2D						
UK Blender	91						
S.A. Bullet	94						
Retron	9D						
Retron	98	9D	94	91	2D	9D	9D
Software		14					
Release		15					11
Number	13	16	18	17	30	12	24
FX A0	*	*	*	*	*	*	*
FX A1	*	*	*	*	*	*	*
FX A2	*	*	*	*	*	*	*
FX A3	*	*	*	*	*	*	*
ED A3	*	*	*	*	*	*	*
FX A4	*	*	*	*	*	*	*
FX A5	*	*	*	*	*	*	*
FX A6	*	*	*	*	*	*	*
FX A7	*	*	*	*	*	*	*
FX A9	*	*	*	*	*	*	
FX AA			*		*	*	
ED AA			*		*	*	

Figure B.4.-2. Group II Dispenser Function Codes

Dispenser ID									
TCS	45								
TCS	55								
TCS	A5								
TCS	B5								
MMD/TCS	26								
MMD/TCS	36								
MMD/TCS	86								
MMD/TCS	96								
Model 242/244	06	96	86	36	26	B5	A5	55	45
		20							
		21	21						
		22	22						
		25	25	25	25				
		27	27	27	27				
Software		28	28	28	28				
Release		33	33	33	33				
Number	19	34	34	34	34	27	27	27	27
FX A0	*	*	*	*	*	*	*	*	*
FX A1	*	*	*	*	*	*	*	*	*
FX A2	*	*	*	*	*	*	*	*	*
FX A3	*	*	*	*	*	*	*	*	*
ED A3	*	*	*	*	*	*	*	*	*
FX A4	*	*	*	*	*	*	*	*	*
FX A5	*	*	*	*	*	*	*	*	*
FX A6	*	*	*	*	*	*	*	*	*
FX A7	*	*	*	*	*	*	*	*	*
FX A9	*	*	*	*	*	*	*	*	*
FX AE 01	*	*	*	*	*	*	*	*	*
FX AE 10	*	*	*	*	*	*	*	*	*
FX AE 20	*	*	*	*	*	*	*	*	*
FX AE 32	*	*	*	*	*	*	*	*	*
CX A1	*	*	*	*	*	*	*	*	*
CX A2	*	*	*	*	*	*	*	*	*
CX A3	*	*	*	*	*	*	*	*	*

Figure B.4-3. Group III Dispenser Function Codes

Dispenser ID								
Blender	20							
Blender	30							
Blender	80							
Blender	90							
262A	26							
262A	29							
262A	86							
262A	99	86	29	26	90	80	30	20
Software Release Number	26	26	26	26	35	35	35	35
FX A0	*	*	*	*	*	*	*	*
FX A1	*	*	*	*	*	*	*	*
FX A2	*	*	*	*	*	*	*	*
FX A3	*	*	*	*	*	*	*	*
ED A3	*	*	*	*	*	*	*	*
FX A4	*	*	*	*	*	*	*	*
FX A5	*	*	*	*	*	*	*	*
FX A6	*	*	*	*	*	*	*	*
FX A7	*	*	*	*	*	*	*	*
FX A9	*	*	*	*	*	*	*	*
FX AE 01	*	*	*	*	*	*	*	*
FX AE 10	*	*	*	*	*	*	*	*
FX AE 20	*	*	*	*	*	*	*	*
FX AE 32	*	*	*	*	*	*	*	*
CX A1	*	*	*	*	*	*	*	*
CX A2	*	*	*	*	*	*	*	*
CX A3	*	*	*	*	*	*	*	*

Figure B.4-4 Group III Dispenser Function Codes

Dispenser	ID							
TCS Taiwan	26							
TCS Taiwan	36							
TCS Taiwan	86							
TCS Taiwan	96							
262A Taiwan	26							
262A Taiwan	29							
262A Taiwan	86							
262A Taiwan	99	86	29	26	96	86	36	26
Software Release Number	31	31	31	31	32	32	32	32
FX A0	*	*	*	*	*	*	*	*
FX A1	*	*	*	*	*	*	*	*
FX A2	*	*	*	*	*	*	*	*
FX A3	*	*	*	*	*	*	*	*
ED A3	*	*	*	*	*	*	*	*
FX A4	*	*	*	*	*	*	*	*
FX B5	*	*	*	*	*	*	*	*
FX A6	*	*	*	*	*	*	*	*
FX A7	*	*	*	*	*	*	*	*
FX A9	*	*	*	*	*	*	*	*
FX AE 01	*	*	*	*	*	*	*	*
FX AE 10	*	*	*	*	*	*	*	*
FX AE 20	*	*	*	*	*	*	*	*
FX AE 32	*	*	*	*	*	*	*	*
CX A1	*	*	*	*	*	*	*	*
CX A2	*	*	*	*	*	*	*	*
CX A3	*	*	*	*	*	*	*	*

Figure B.4-5 Group III Dispenser Function Codes

B.5 DISPENSER STATUS BYTES

A dispenser status byte is returned from a fueling point to the controller after a controller status request, and in the response to most commands. The dispenser processor modifies this status byte to reflect dispenser sale conditions.

An additional auxiliary dispenser status byte is returned when a dispenser is configured for island authorization.

The following sections define dispenser status bytes.

B.5.1 NORMAL DISPENSER STATUS BYTE

Normal dispenser status bytes are listed in Figure B.5.1-1 in hexadecimal form. When a dispenser status byte does not match any of those listed, the fueling point status can be determined by evaluating specific bits set in the returned status byte.

Bits 7, 6, 4, 3, 1, and 0 are useful in determining active fueling point conditions. Dispenser conditions corresponding to each status bit in the status byte returned by an active fueling point and by an idle fueling point are described in Figures B.5.1-2 and B.5.1-3.

B.5.2 AUXILIARY DISPENSER STATUS BYTE

When configured for island authorization, certain dispensers in Group III will return a bit-mapped auxiliary status byte, in addition to the normal status byte. Figure B.5.2-1 contains bit definitions for the auxiliary dispenser status byte.

Status Byte	Fueling Point State
2F	Uninitialized fueling point; fueling point requires main display data sent with function code A6.
20	Idle fueling point - handle down. Returned by some models while the handle is still up following a completed preset sale.
24	Handle activated - no start button pressed.
A0	Idle fueling point - handle up - fueling point is not authorized. This status is a request for fueling point authorization.
A1	Idle fueling point - handle up - credit sale. Sent only by Group III dispensers. Bit 0 indicates a cash (0) or credit (1) sale. Bit 0 allows the controller to detect the status change (A0 - A1 - A0).
90	1) Group II and III dispensers: Handle up - fueling point authorized - no valves open. Returned after an A5 Authorize command is accepted, but before the valves open, during the segment check and display blanking cycles. 2) Group I dispensers: Sale in progress, only slow flow valve open. Pulser check active, waiting for 10th pulse.
D0	Sale in progress, only slow flow valve open. Pulser check active, waiting for 10th pulse.
F0	Sale in progress, both valves open.
94	Sale in progress, only slow flow valve open, approaching maximum delivery. Group I dispensers only.
D4	Group II and III dispensers: Sale in progress, only slow flow valve open. Approaching maximum delivery.
91, 95	Sale terminated (due to lowered handle or max delivery reached).
91	Fuel delivery stopped by an island preset.
98, 9C	In-progress sale halted.
99, 9D	Handle lowered during halted sale; sale terminated.
9A, 9E	Halted sale has been resumed.

Figure B.5.1-1. Normal Fueling Point Status Bytes

Status Bit	Definition		
7	Handle Flag	Always 1 during a sale	
6	Slow Flow Valve	1 = Valve Open	0 = Valve Closed
5	Fast Flow Valve (Pilot Valve)	1 = Valve Open	0 = Valve Closed
4	Authorize Flag	Always 1 during a sale	
3	Halted Flag	1 = Halted Sale	0 = Not Halted
2	Slow Flow Flag	1 = In Slow Flow	0 = Not In Slow Flow
1	Resume Flag	1 = Resume Received	0 = Resume Not Received
0	Maximum Delivery Flag	1 = Max Delivery Met	0 = Max Delivery Not Met

Figure B.5.1-2. Active Fueling Point Status Byte Bit Map

Status Bit	Definition		
7	Handle Flag	1 = Handle up	0 = Handle down
6	Always 0		
5	Always 1		
4	Always 0		
3	Always 0		
2	Always 0		
1	Always 0		
0	Cash/Credit[1]		

1) Bit 0 has significance only on a Cash/Credit fueling point when the handle is up (bit 7 = 1).

Figure B.5.1-3. Idle Fueling Point Status Byte Bit Map

Status Bit	Definition
7	0 (Unassigned)
6	0 (Unassigned)
5	0 (Unassigned
4	1 = Island Authorization Device present
3	Current transaction Master is: 0 - controller 1 - island authorization device
2	1 = Island Authorization Device reserve request sent to fueling point; fueling point awaiting controller response.
1	1 = Fueling point reserved by the island authorization device.
0	1 = Fueling point reserved by the controller

Figure B.5.1-3. Idle Fueling Point Status Byte Bit Map

B.6 STATE TABLES

State tables have been developed which show the normal sequence of events in fueling point operation and the corresponding fueling point status. Each fueling point state is represented by a unique fueling point status code.

The following factors relate to the use of the state tables in programming a controller for dispenser communication.

1) All status bytes should be masked by ANDing with F9H.

2) Bit 4 is cleared in an idle status byte; bit 4 is set in an active sale status byte.

3) A sale should not be considered active until the second active status code is received after an A5 Approval command.

4) When an idle status code (20, A0, or A1) is received after a fueling point has been determined to be in an active sale, the controller should record the final money/volume sale amount from the fueling point.

5) If status code 2F is returned, the most recent fueling point display data sent from the fueling point to the controller should be downloaded to the fueling point and used as the final sale amount.

6) In the tables which follow, OL indicates an off-line state.

Figures B.6-1 through B.6-5 contain state tables for Tokheim dispensers. State tables are presented for F8 dispensers and for UDC dispensers. In each figure, the possible states are listed across the top; the events which cause a change of state are listed along the left side of the figure.

For each event which causes a state change, the figure lists by number the procedure to follow and the next state. Procedures are described in Figure B.6-6.

EVENT	2F	20	A0	90	D0	F0	98	91	99	0L
Reg. ID (FxA0)	P30:2F	P30:20	P30:A0	P30:90	P30:D0	P30:F0	P30:98	P30:91	P30:99	
Req. Display Data (FxA1)	P31:2F	P31:20	P31:A0	P31:90	P31:D0	P31:F0	P31:98	P31:91	P31:99	
Req.Status (FxA2)	P43:2F	P43:20	P43:A0	P43:90	P43:D0	P43:F0	P43:98	P43:91	P43:99	
Halt (FxA3)				P05:98	P05:98	P05:98		P05:99		
Resume (FxA4							P06:D0		P06:91	
Authorize Sale (FxA5)			P08:90							
Send Main Display Data (Fx/A6	P00:20	P33:20	P34:A0							
Reset (FxA7)	P44:2F	P44:2F	P44:2F	P44:2F	P44:2F	P44:2F	P44:2F	P44:2F	P44:2F	
Request S.A. Ttls (FxA9)	P38:2F	P38:20	P38:A0							
Request Act. Hose and MOP (DxA1)			P39:A0							
Acknow. Deactiv. Hose (DxA2)		P40:20								
Send Aux Price Disp Data (DxA3)		P41:20	P42:A0							

Figure B.6-1. F8 Dispenser State Table: Controller-Originated Events

EVENT	2F	20	A0	90	D0	F0	98	91	99	OL
Hose Activated		P01:24								
Hose de-activated			P11:20	P12:20	P12:20	P12:20	P12:20	P12:20	P12:20	
Segment Check Complete				P09:D0 or P09:90						
Pulser Check Limit Reached					P10:F0					
No pulses for 0.5 seconds						P13:D0 or P13:90				
Preset Slow Down Reached						P13:D0				
Console Max Del Reached					P14:20	P14:20	P14:20			
AC Power Loss	P19:2F	P19:20	P19:A0	P19:91	P15:91 P	P15:91	P15:91	P15:99	P15:99	
Power Down Timer Exp	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	
Manager's Key On	P18:0L	P18:0L								
Manager's Key Off										P20:2F
AC Power On										P21:20 or P21:2F

Figure B.6-2. F8 Dispenser State Table: Dispenser-Originated Events

EVENT	CURRENT STATE 2F	20	24	A0	A1	90	D0	F0	98	91	99	OL
Req. ID (FxA0)	P30:2F	P30:20	P30:24	P30:A0	P30:A1	P30:90	P30:D0	P30:F0	P30:98	P30:91	P30:99	
Req. Display Data (FxA1)	P31:2F	P31:20	P31:24	P31:A0	P31:A1	P31:90	P31:D0	P31:F0	P31:98	P31:91	P31:99	
Req.Status (FxA2)	P32:2F	P32:20	P32:24	P32:A0	P32:A1	P32:90	P32:D0	P32:F0	P32:98	P32:91	P32:99	
Halt (FxA3)						P05:98	P05:98	P05:98		P05:99		
Resume (FxA4									P06:D0		P06:91	
Authorize Sale (FxA5)				P08:90	P08:90							
Send Main Display Data (Fx/A6	P00:20	P33:20	P34:24	P34:A0	P34:A1							
Reset (FxA7)	P35:2F	P35:20	P35:24	P35:A0	P35:A1	P36:91	P36:91	P36:91	P36:91	P36:91	P36:91	
Request S.A. Ttls (FxA9)	P38:2F	P38:20	P38:24	P38:A0	P38:A1							
Set Cash MOP & Hose (FxAE01)		P01:20	P01:24	P01:A0	P01:A1							
Set Credit MOP & Hose (FxAE01)		P02:20	P02:24	P02:A0	P02:A1							
Request Act. Hose and MOP (CX/DxA1)				P39:A0	P39:A1							
Acknow. Deactiv. Hose (CX/DxA2)		P40:20	P40:24									
Send Aux Price Disp Data (CX/DxA3)		P41:20	P42:24	P42:A0	P42:A1							

Figure B.6-3. UDC Dispenser State Table: Controller-Originated Events

EVENT	CURRENT STATE 2F	20	24	A0	A1	90	D0	F0	98	91	99	OL
Hose Activated		P07:24										
Hose de-activated			P11:20	P11:20	P11:20	P12:20	P12:20 or P21:91	P12:20 or P21:91	P12:20 or P21:91	P12:20 or P21:91	P12:20	
Nozzle Inactive, Timer Exp										P22:20	P22:20	
Cash TCS Start Button Pressed			P01:A0									
Credit TCS Start Button Pressed			P02:A1									
Segment Check Complete						P09:D0						
Pulser Check Limit Reached							P10:F0					
No pulses for 5.0 seconds								P13:D0				
Preset Slow Down Reached								P13:D0				
Console Max Del Reached							P05:20	P05:20	P05:20			
Island Preset Max Del Reached							P05:91	P05:91	P05:91			

Figure B.6-4. UDC Dispenser State Table: Dispenser-Originated Events, Part 1

EVENT	CURRENT STATE 2F	20	24	A0	A1	90	D0	F0	98	91	99	OL
Higher Island Pst Button Pressed										P16:D0	P16:98	
AC Power Loss	P19:2F	P19:20	P19:24	P19:A0	P19A1	P19:98	P15:98	P15:98	P15:98	P15:99	P15:99	
Power Down Timer Exp	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	P17:0L	
Manager's Key On	P18:0L	P18:0L										
Manager's Key Off												P20:2F
AC Power On												P14:20 or P14:2F
Comm Loss (Slectable Return)							P23:98	P23:98				

Figure B.6-5. UDC Dispenser State Table: Dispenser-Originated Events, Part 2

P00: Load received main display data and change status to idle.

P01: Blank credit prices, lock in cash selection.

P02: Blank cash prices, lock in credit selection.

P05: Turn off valves and motor control

P06: Allow valves and motors to be turned on if maximum delivery not reached.

P07: Record active hose and turn on motor.

P08: Begin sale

P09: Open slow flow valve

P10: Open slow flow and fast flow valve

P11: Record inactive nozzle

P12: Record inactive nozzle, turn off valves and motor, and terminate the sale

P13: Turn off the fast flow valve

P14: Initialize dispenser

P15: Turn off valves and motor and start power-down timer

P16: Continue an island preset sale

P17: Go to sleep

P18: Perform Manager's mode functions

P19: Start power-down timer

P20: Enter Manager's modes

P21: Record inactive nozzle, turn off valves and motor, terminate the sale, and start nozzle inactive timer.

P22: Release end-of-sale nozzle lock-up

P23: Halt dispenser

Figure B.6-6. Description of Procedures, Part 1

P30: Return fueling point software ID

P31: Return current fueling point main display data

P32: Return fueling point status

P33: Load received main display data

P34: Load received main display data if price change with handle up allowed

P35: Clear diagnostic errors if enabled

P36: Terminate sale (if Group III or F8-262 dispenser)

P37: Terminate sale

P38: Return fueling point totals

P39: Return active hose and MOP

P40: Return acknowledgement of hose disapproval

P41: Load prices to auxiliary display

P42: Load prices to auxiliary display if price change with handle up allowed

P43: Return fueling point status; update fueling point display if address different than fueling point

P44: Restart dispenser software execution (if not a 262 F8 dispenser)

Figure B.6-6. Description of Procedures, Part 2

APPENDIX C - CONTROLLER CHARACTERISTICS

Tokheim dispenser controllers range from simple single-product dispenser controllers to complex Point-Of-Sale (POS) fuel and dry goods sales systems. This appendix describes controller features which relate to dispenser communication.

Tokheim controllers are designed to transmit function codes which are recognized by Tokheim dispensers. Not all controllers can transmit all function codes. Each controller is designed for use with particular dispenser types.

Dispenser interface equipment required for communication between a controller and dispensers is described in Appendix D.

The following sections describe features of Tokheim Model 908, Model 179/182, and Model 83/184/185 controllers which affect communication between the controllers and fueling points.

C.1 MODEL 908 CONTROLLER

The Model 908 controller can handle up to 8 single-product fueling points.

(Further information on the Model 908 controller will be added in the future.)

C.2 MODEL 179/182 CONTROLLERS

The standard Model 179/182 controllers (MEMS II/III) communicate with domestic dispensers only. The Model 179 I controller is available for communication with international dispensers only. The international version uses function codes which include additional bytes in some communications with international dispensers.

Model 179/182 controllers are equipped with one asynchronous dispenser communication channel with two external connectors. Each connector is designed to handle communication with up to 8 fueling points, although as many as 16 can be handled through one connector to a 67 box. The 16 fueling points are assigned to addresses 0-F hex.

A Model 179/182 controller has 16 10-position switches, with one switch assigned to each fueling point. Each switch is set to indicate the type of fueling point assigned to that address. Switch positions 1 through 5 correspond to fuel grades 1 through 5 on a single-grade fueling point. Switch position 6 indicates one of three products assigned to each of three fueling positions on a three-product fueling point. Switch positions 7-10 are unassigned, and represent off-line or nonexistent fueling points. Only fueling points corresponding to a switch position from 1-6 inclusive will be polled in the polling cycle; any fueling point whose corresponding switch is set to a position from 7-10 will not be polled. Figure C.2-1 summarizes this information.

Switch Position	Dispenser Type	Fuel Grades
1-5	Single-product dispenser	1-5
6	Three-product MMD	1-3
7-10	Unassigned	Unassigned

Figure C.2-1. Model 179/182 Controller Switch Positions

Model 179/182 controller-dispenser communication has been designed using interrupts which occur at approximately 13-msec time intervals. Each command is allocated a fixed multiple of these 13-msec intervals for command transmission.

The time interval required for command transmission varies with the function code. Each function code can be issued to a fueling point only at a fixed point in the polling cycle; the relative starting time for the command depends on the function code issued.

A default polling sequence will occur in the absence of other commands. The default polling sequence occurs over 7 13-msec intervals, repeating at approximately 91-msec intervals. The 91-msec cycle time is referred to in this document as the polling cycle. In the default polling sequence, the controller will poll a fueling point and request sale data with the A1 function code. After approximately 52 msec, the controller will poll a fueling point for status with the A2 function code. If the polled fueling point is part of an MMD-type dispenser, an Aux A3 function code will also be issued. This happens 13 msec after the A2 command is sent.

After the A2 command is transmitted to a fueling point, all other F8 computer board-based fueling points which are not dispensing product will refresh their displays.

Approximately 39 msec after the A2 command is issued, the controller will again issue an A1 command. This alternating A1 - A2 (- Aux A3) polling sequence will continue indefinitely, until a change in fueling point status or an operator action causes the controller to issue another function code.

The A1 function code will be transmitted repeatedly to the fueling point currently selected for display at the controller. If a sale becomes due on another fueling point, the controller will send an A1 command to the fueling point with the due sale to request sale data, then resume transmitting the A1 command to the currently-displayed fueling point.

The A2 function code is used by the controller to sequentially poll all fueling points which have been set to a defined switch position (position 1-6). If the switch for a polled fueling point has been is set to position 6 (MMD dispenser), an Aux A3 command (Download price display) will be issued to the same fueling point following the A2 command.

When any other command is issued by the controller, the default polling sequence will be interrupted while the function code is transmitted, then the default polling cycle will be resumed. Since each function code can be issued by the controller only at a fixed point in the polling cycle, default polling will be continued from the point in the timing cycle when transmission of other commands is completed.

Certain commands assigned to the same time interval in the polling cycle have priority over other commands which could be issued at the same time. A3 Halt and A4 Resume commands take precedence over A1 commands.

Activating the Emergency Stop switch on a controller causes the controller to issue an A3 Halt command, using the ED prefix to address all fueling points at once. Because confirming responses from multiproduct dispensers could interfere with communications, the Halt command is transmitted 10 times in rapid succession, to ensure that all fueling points have received the transmission.

Figure C.2-2 lists the function codes which can be transmitted by the Model 179/182 controllers. Each function code can be issued by the controller only at certain fixed points in the polling cycle.

Figure C.2-3 shows when each function code can be issued in the approximately 91-msec polling cycle, and the time interval required for transmission of each command and reception of the anticipated response. Polls are delimited by the 13-msec interrupt intervals.

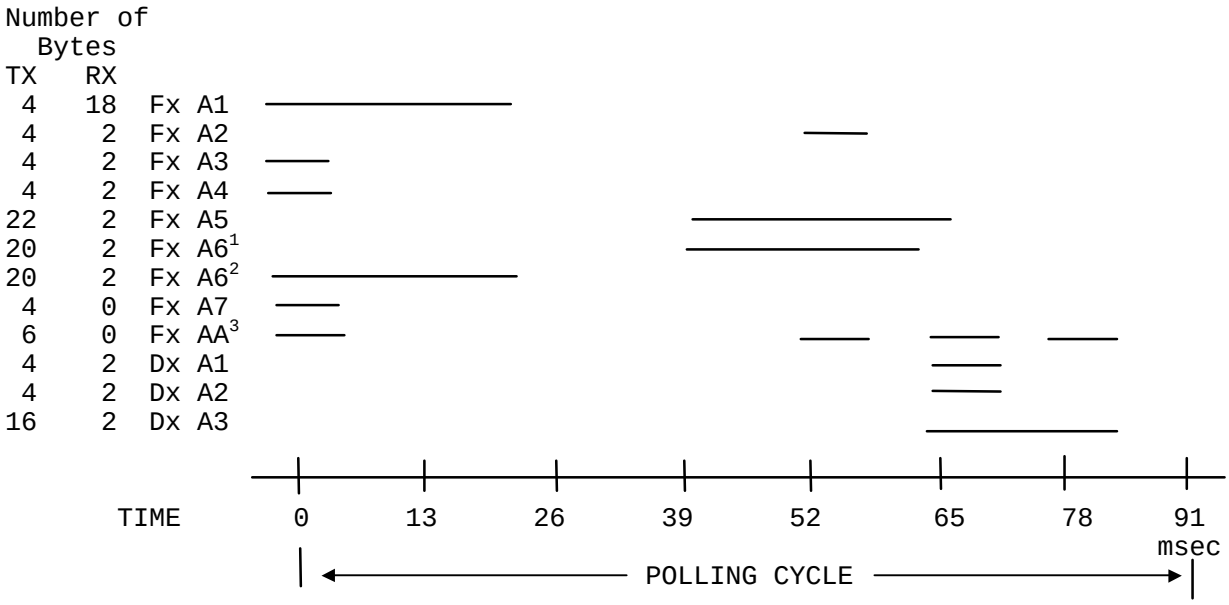
Figure C.2-4 contains an example showing a typical sequence of commands from a controller to an MMD dispenser during the course of a sale.

ADDRESS	FUNCTION CODE	DESCRIPTION
Fx	A1	Request fueling point display data
Fx	A2	Request fueling point status
Fx	A3	Halt sale and turn valves off
ED	A3	Halt sales and turn valves off at all fueling points
Fx	A4	Resume sale and turn valves on
Fx	A5	Authorize fueling point
Fx	A6	Send data for fueling point main displays
Fx	A7	Reset fueling point
Fx	AA	Set fueling point display control data
Dx	A1[1]	Request activated hose and MOP
Dx	A2[1]	Acknowledge deactivated hose
Dx	A3[1]	Send prices for fueling point auxiliary displays

x = 0-F Hex, designating fueling points 1-16, respectively

1) Transmitted only by 179DP and 182CDP controllers.

Figure C.2-2. Model 179/182 Function Codes



1) The A6 poll is issued at this point in the polling cycle when used to download data for main displays for a price change.

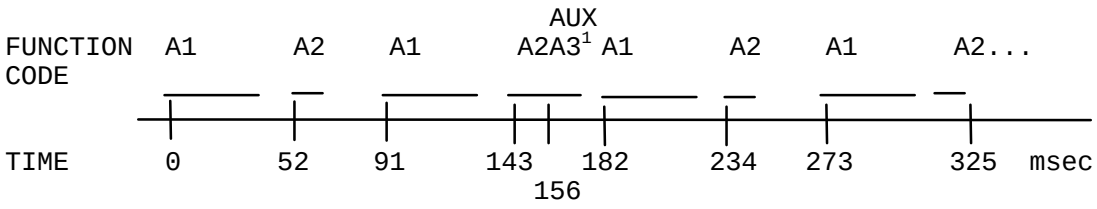
2) The A6 poll is issued at this point in the polling cycle when used to download data for main displays for an uninitialized fueling point (status 2F).

3) The AA code can be issued at any one of four points in the polling cycle, as shown.

Figure C.2-3. Model 179/182 Polling Cycle

```
 FUNCTION CODE                DESCRIPTION OF FUNCTION

Fueling point is Idle -

      Fx A2      Poll MMD fueling point for its status.
      Dx A3      Send auxiliary price display data to MMD fueling point.

Fueling point selected for sale at controller -

      Fx A1      Request fueling point display data.
      Fx A2      Request fueling point status.
      Fx A6      Send data for main displays if in Cash/Credit mode and
                 if there is a change from one mode to the other.
      Dx A3      Send auxiliary price display data to MMD fueling point.
      Fx A1      Request fueling point display data.

Handle is raised on fueling point -

      Fx A2      Request fueling point status.
      Dx A1      Request activated hose and MOP on MMD fueling point.
      Fx A1      Request fueling point display data
      Fx A5      Authorize MMD fueling point.
      Fx A2      Request fueling point status.
      Dx A3      Send prices for aux displays to MMD fueling point.

Sale in progress on fueling point -

      Fx A1      Request fueling point display data.
      Fx A2      Request fueling point status.
      Dx A3      Send auxiliary price display data to MMD fueling point.
      Fx A1      Request fueling point display data.
      Fx A2      Request fueling point status.
      Dx A3      Send auxiliary price display data to MMD fueling point.

Sale is terminated; fueling point is Idle -

      Fx A1      Request fueling point display data.
      Fx A2      Request fueling point status.
      Dx A2      Acknowledge deactivated hose on MMD fueling point.
      ...        Repeat A2 - Aux A3 polling.
```

Figure C.2-4. Typical Sequence of Commands From 179/182 Controller to an MMD



Fx A1 Controller polls fueling point (m) for display data.

Fx A2 Controller polls fueling point (n) for its status byte.

Fx A1 Controller polls fueling point (m) for display data.

Fx A2 Controller polls MMD fueling point (n+1)for its status byte.
DxA3 Controller sends auxiliary price display data to MMD fueling point (n+1).

FX A1 Controller polls fueling point (m) for display data

Fx A2 Controller polls fueling point (n+2) for its status byte.

Fx A1 Controller polls fueling point (m) for display data.

Fx A2 Controller polls fueling point (n+3) for its status byte.

---

1) The controller switch position for this fueling point address (n + 1) indicates an MMD-type dispenser, so an AUX A3 will be issued 13 msec after each A2 command to this fueling point address.

Figure C.2.5. Default Model 179/182 Polling Sequence (Domestic Controllers)

FUNCTION CODE	DESCRIPTION OF FUNCTION CODE
Fx A1	Controller polls fueling point (m) for display data.
Fx A2	Controller polls fueling point (n) for its status.
Fx A1	Controller polls fueling point (m) for display data.
Fx A2	Controller polls MMD fueling point (n+1)for its status byte.
DxA3	Controller sends auxiliary price display data to MMD fueling point (n+1).
FX A1	Controller polls fueling point (m) for display data
Fx A2	Controller polls fueling point (n+2) for its status.
DX A1	Controller requests activated hose and MOP on MMD fueling point (n+2).
Fx A1	Controller polls fueling point (m) for display data.
Fx A2	Controller polls fueling point (n+3) for its status.
Fx A1	Controller polls fueling point (m) for display data.

Figure C.2-6. Example Model 179/182 Controller Polling Sequence (Domestic Controllers)

C.3 MODEL 83, 184, AND 185 CONTROLLERS

The Model 83/184/185 (DHC, MEMS IV, AND MEMS V) controllers can be used for communication with all domestic and international dispensers. Some commands require additional bytes when used for communication with international dispensers; these controllers automatically insert the additional bytes as needed.

These controllers can conduct simultaneous dispenser communication over two independent asynchronous dispenser communication lines. Each line is capable of communication with 16 fueling points assigned to addresses 0-F hex, for a total of 32 fueling points under control of each controller. (A maximum of 24 fueling points can be controlled from the keyboard of a Model 184 or Model 185 controller.)

On each line, fueling point addresses 0-F hex are polled by the controller sequentially. The controller polls each of the 16 fueling point addresses in order, then repeats polling, starting again with the first fueling point address. Polling on each line will be conducted independently of the other line, so that communication on the lines will not normally be synchronized. The remainder of this section will refer to only one of the communication lines, but all information is applicable to both lines.

If no response is received to a controller poll, or fewer bytes are received than expected, or the double-talk bytes do not match, the controller will immediately reissue the same function code and wait for a response. (After an A0 command, Request Fueling Point ID, no retry or error occurs following no response or a bad response.) If a valid response to the second transmission is not detected, the controller increments a communication error counter.

Not all function codes require a fueling point response. If no response is required, no communication error will be counted. In addition to the immediate communication retry described above, a controller is programmed to attempt a fixed number of communication retries, based on the function code issued and the dispenser type involved in communication. Retries are used to reduce missed communications due to external interference and to problems inherent in the interface between the controller and the varying technologies used in different dispenser types.

The retry count for each function code and dispenser type is set within the range of 0-255 during software development, and is not variable by the user. If a valid response has not been received after the programmed number of communication retries, the fueling

point address will be declared off-line, the retry counter for that address will be reset to 0, and the controller will proceed to the next fueling point address.

The controller will poll fueling point addresses 0-F hex in sequence, repeating the polling sequence indefinitely. Any command which must be sent to a fueling point is queued in the controller until the fueling point address is polled, then the command is sent. The next command to the same fueling point must wait until the fueling point address is polled again.

Controller-dispenser communication has been designed using interrupts which occur at 10-msec time intervals. Each function code requires a fixed multiple of 10-msec intervals for command transmission. The time interval required for command transmission varies with each function code. Figure C.3-1 lists the function codes which can be transmitted by the Model 83/184/185 controllers, and the time interval required for transmission of each function code. Intervals are measured in multiples of the 10-msec interrupt interval. The controller employs a full duplex line, therefore a fueling point response does not affect transmission of the next command.

ADDRESS	FUNCTION CODE	TX TIME (msec)	DESCRIPTION
Fx	A0	20	Request fueling point ID
Fx	A1	20	Request fueling point display data
Fx	A2	20	Request fueling point status
Fx	A3	10	Halt sale and turn valves off
ED	A3	500	Halt sales and turn valves off at all fueling points
Fx	A4	10	Resume sale and turn valves on
Fx	A5	30	Authorize fueling point
Fx	B5	30	Authorize fueling point
Fx	A6	30	Send data for main displays
Fx	A7	10	Reset fueling point
Fx	A9	10	Request single-product Stand Alone fueling point totals
Fx	A9	10	Request multi-product Stand Alone fueling point hose totals
Fx	AE 01	20	Set UDC MOP and hose
Fx	AE 10	10	Request fueling point reserve
Fx	AE 20	10	Request fueling point unreserve
Cx, Dx	A1	10	Request activated hose and MOP on MMD
Cx, Dx	A2	10	Acknowledge deactivated hose on MMD
Cx, Dx	A3	20	Send prices for MMD auxiliary displays
Fx	AF	--	Request attendant control key code

Figure C.3-1. Model 83/184/185 Function Codes

When a controller is first connected to the dispensers and power is applied, all fueling points are assumed to be off-line. The controller initiates sequential polling by requesting identification from the first fueling point, using function code A0. If a fueling point does not respond, or replies with an invalid response, the fueling point remains off-line, and the controller polls the next fueling point address. The controller does not perform an automatic retry for the A0 function code, and no errors are accrued for invalid or missing responses. If a fueling point responds with a valid ID, the controller compares the ID to an internal list of valid dispenser IDs, marks the fueling point address on-line, determines the appropriate function code set for the fueling point based on the response, and polls the next fueling point address.

After each fueling point address has been polled once with the A0 function code, the controller continues sequential polling of all addresses. Any fueling point address which did not respond properly to an A0 poll will continue to be polled with the A0 function code each time that the fueling point address is encountered in the polling sequence. A valid ID is required before any other fueling point communication can occur. Each on-line fueling point address is polled with the A1 function code to request the current fueling point display data. The controller will poll on-line fueling point addresses indefinitely with the A1 function code until another command is required.

The minimum time to complete an A0/A1 polling sequence for fueling point addresses 0-F hex requires 480 msec. In the absence of other commands, each fueling point will be polled and its status updated at approximately 1/2 second intervals.

If an on-line fueling point does not respond properly to a controller transmission within the specified number of retries, the fueling point address will be declared off-line, and the controller will resume polling that address with the A0 function code. When a valid ID is returned, the address will again be polled as an on-line fueling point.

A fueling point response may include a fueling point status byte. Some dispenser types are unable to update the status before returning a command response; these fueling points will return the status of the fueling point prior to execution of the function specified in the command. To ensure correct status detection, the user should not rely on the status returned immediately following transmission of a function code which is expected to cause a change in the fueling point status. The status returned by the fueling point in the next polling sequence will reflect the updated fueling point status.

Commands are queued within the controller memory for each on-line fueling point address. When an on-line address is polled, the controller checks the message buffer for commands awaiting transmission to that address, and sends a command if one is present. Remaining commands are issued on succeeding polls to that fueling point address. If no command is queued, the A1 poll is issued. An application program, operator action, or a change in fueling point status may cause transmission of another function code in place of the A1 poll to a fueling point address. Function code A2, Request Fueling Point Status, is used by the Model 83/184/185 controllers to synchronize fueling point display refresh cycles on some older dispenser types (dispensers using F8 computer boards). Any status returned by these dispensers in response to an A2 command is ignored by the controller. The A2 function code is routinely sent immediately following every A0 or A1 function code, with no pause for a response between the two function codes. The format used is Fx An Fx A2, where An = A0 or A1. This command sequence requires 30 msec for transmission.

The fueling point addressed in the command responds normally to the A0 or A1 command, and ignores the A2 command. (Some dispenser types may recognize and respond to both function codes.) Fueling points which are not addressed receive the An command and perform a display refresh cycle and update their displayed data. By polling each fueling point address sequentially, each fueling point display is refreshed 15 out of 16 times in the polling cycle. The A2 function code is never used by these controllers to determine the fueling point status.

Taiwan TCS or 262 dispensers may return an error code in response to an A2 command. Taiwan 83/184/185 controllers use this error code to determine when an error condition exists at the dispenser. The error code is cleared when the Taiwan controller sends an A7 Reset command.

The A3 function code is used to halt a fueling point or cause an Emergency Stop on all fueling points. When the operator requests an Emergency Stop, the controller sends the A3 function code, using the ED prefix to address all fueling points simultaneously. To ensure that the command is received by all fueling points, the ED A3 code is transmitted 50 times, to maximize the possibility that every fueling point has received the command. This sequence occupies approximately 500 msec. of transmission time. All fueling points will Halt after a ED A3 command, but none will respond to the controller. After an Emergency Stop, the controller will resume the normal polling cycle with the next fueling point in sequence.

When a change in handle status is detected in the response from an MMD or UDC fueling point to an A1 command, the controller will immediately issue a command to request the activated hose and MOP or to acknowledge hose deactivation, before continuing to the next fueling point in the polling cycle. The normal retry procedure is used for these commands independently of the A1 command.

An A5 or B5 Authorize Fueling Point command is sent by the controller after the fueling point handle has been raised. If an Aux board is present, the Aux A1 Request Activated Hose and MOP command must be accepted at the fueling point and a handle status returned, before an A5 or B5 Authorize Fueling Point command can be transmitted. Currently, the B5 function code is used only in communication with Taiwan dispensers; the A5 function code is used for all other dispensers.

The Aux A3 Send Prices for Auxiliary Displays command is appended to an A6 Send Data for Main Displays command. A fixed number of filler bytes (all zeros with no double-talk bytes) is inserted between the two commands. The fueling point will respond to both commands.

The Aux A2 Acknowledge Deactivated Hose command is sent by the controller automatically when the fueling point handle is lowered.

FUNCTION CODE[1]	DESCRIPTION OF FUNCTION CODE
A1	Controller polls fueling point n for display data.
A1	Controller polls fueling point n+1 for display data.
A0	Controller polls off-line fueling point n+2 for ID byte.
A5	Controller authorizes fueling point n+3.
A4	Controller resumes sale on fueling point n+4
A0	Controller polls off-line fueling point n+5 for ID byte.
A1	Controller polls fueling point n+6 for display data.
A3	Controller halts fueling point n+7.

1) An A2 command will follow each A0 or A1 command issued.

Figure C.3-2. Example Model 83/184/185 Polling Sequence

APPENDIX D - CONTROLLER DISPENSER INTERFACE EQUIPMENT

All communication described in this document takes place between the controller and the dispenser interface equipment connected to the dispensers. This link consists of a three-wire communication channel between the controller and each dispenser interface box. The three lines are designated TTC (talk to controller), TTD (talk to dispenser), and DCC (DC common).

Dispenser interface equipment is required to connect Tokheim controllers and Tokheim dispensers. The dispenser type determines the interface equipment required for communication. The sections which follow describe each type of Tokheim interface equipment.

D.1 MODEL 94 COMPUTER POWER CENTER

The Model 94 Computer Power Center (94 box) contains up to eight sets of F8 computer boards and fueling point control boards, battery backup, a controller communication interface circuit, and other dispenser control circuits.

The Model 94 box is placed in a central location and connected to the controller. Wires are connected to each fueling point for money pulse input, and AC valve and motor control. An analog output is provided to send a battery voltage signal directly to the controller.

The Model 94 box is used with Tokheim 1200 series dispensers.

D.2 MODEL 98 COMPUTER POWER CENTER

The Model 98 Computer Power Center (98 box) contains up to eight sets of F8 computer boards and fueling point control boards, battery backup, a controller communication interface circuit, and other dispenser control circuits.

The Model 98 box is placed in a central location and connected to the controller. Wires are connected to each fueling point for display data output, volume pulse input, and AC valve and motor control. An analog output is provided to send a battery voltage signal directly to the controller.

The Model 98 box is used with 162 dispensers. The Model 98 box is also used in conjunction with the Model 95 box with Model 330 and 333 MMDs.

D.3 MODEL 98EU COMPUTER POWER CENTER

The Model 98 European Computer Power Center (98EU box) contains up to eight sets of F8 computer boards and fueling point control boards, battery backup, a controller communication interface circuit, and other dispenser control circuits.

The Model 98EU box is placed in a central location and connected to the controller. Wires are connected to each fueling point for display data output, volume pulse input, and AC valve and motor control. An analog output is provided to send a battery voltage signal directly to the controller.

The Model 98EU box is used with Euro 162 dispensers.

D.4 MODEL 95 AUXILIARY BOX

The Model 95 Aux box contains an Aux board which can support 16 fueling points. The Aux board in the Model 95 interface box performs two functions:

1) it monitors three MMD handles, reporting to the controller which handle is raised. When one handle is authorized, it locks out all other handle signals.

2) it stores fuel prices for the three hoses associated with each fueling point. These prices are periodically transmitted to the fueling point price displays.

The Model 95 Aux box is used with a Model 98 box to control Model 330 and 333 MMD dispensers.

D.5 MODEL 67/67A COMPUTER POWER CENTER

The Model 67 Computer Power Center (67 box) provides an optically-isolated interface for one to sixteen Retron, Model 262, TCS, or UDC stand-alone dispensers. The 67 Box provides one console communication channel which can handle sixteen fueling points, and sixteen dispenser communication lines. The 67 Box is limited to a maximum of sixteen fueling points of any type.

The Model 67A Computer Power Center (67A box) provides an optically-isolated interface for one to sixteen Retron, Model 262, TCS, or UDC stand-alone dispensers. The 67A box is similar to the 67 box except that it provides two separate console communication channels which can each handle sixteen fueling points. Each console communication channel is connected to dispenser communication lines for eight dispensers. When both console communication lines are used, the 67A Box can handle up to sixteen dispensers, with either one or two fueling points per dispenser.

Model 67/67A boxes have no batteries.

Figure D.5-1 illustrates the input and output capacity of the Model 67/67A boxes.

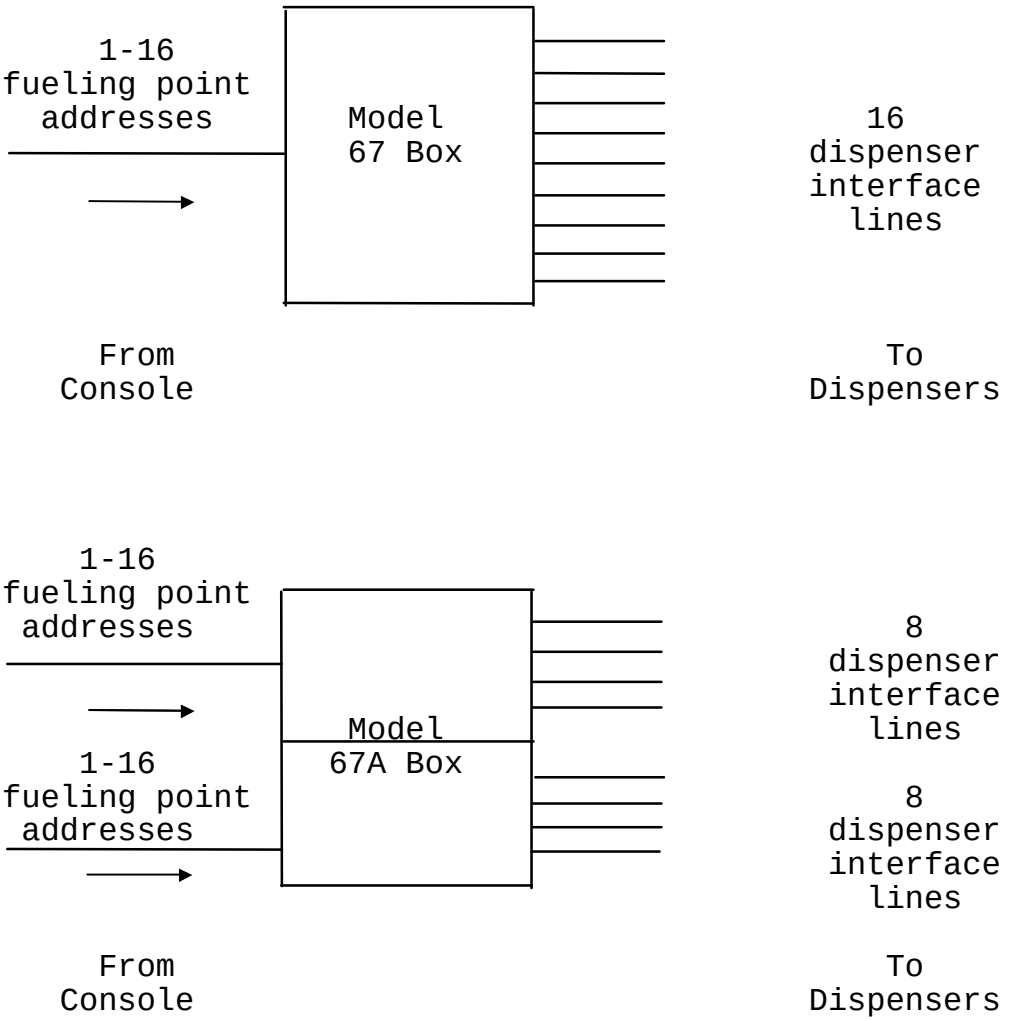


Figure D-5.1. Model 67/67A Box Capacity

D.6 MODEL 67I/67AI COMPUTER POWER CENTER

The Model 67 International Computer Power Center (67I box) provides an optically-isolated interface for one to sixteen international Retrons or Model 262, TCS, UDC, or South African Bullet fueling points.

The Model 67A International Computer Power Center (67AI box) is similar to the 67I box except that it provides two communication channels, where each channel interfaces with one to eight international Retrons or Model 262, TCS, UDC, or South African fueling points.

Model 67I/67AI boxes have no batteries.

D.6 MODEL 67I/67AI COMPUTER POWER CENTER

The Model 67 International Computer Power Center (67I box) provides an optically-isolated interface for one to sixteen international Retrons or Model 262, TCS, UDC, or South African Bullet fueling points.

The Model 67A International Computer Power Center (67AI box) is similar to the 67I box except that it provides two communication channels, where each channel interfaces with one to eight international Retrons or Model 262, TCS, UDC, or South African fueling points.

Model 67I/67AI boxes have no batteries.

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