NAFEM Data Protocol Version 3.0 Application Note

1.0 Introduction

The on-line kitchen is designed to make today's foodservice facilities easier and simpler to operate by automating the management processes for inventory, labor, food safety, asset management, energy consumption and administrative functions.

In response to prompting from national chains, NAFEM was encouraged to lead the effort to develop an industry-wide protocol governing the exchange of information between various pieces of equipment and a central computer workstation.

The early version of the NAFEM Data Protocol (NDP) accomplished this by defining an entire protocol stack from physical layer through application layer. Since new communication technologies are constantly being introduced, the new revision of the NDP has removed the specification of the physical network interface and focused on establishing a set of definitions that can be used in conjunction with any wired or wireless communication approach.

The purpose of this application note is to present version 3.0 of the NAFEM Data Protocol and demonstrate how the data defined in the protocol may be communicated using various communication techniques. This document should be used in conjunction with the Protocol standard to provide a complete understanding of the protocol and typical interactions.

Note that backward compatibility between protocol versions (i.e. 2.0 versus 3.0) is not a requirement.

2.0 Definitions

For purposes of this document, "host" refers to a host computer or some other device that is sending data (i.e. commands) or receiving data (i.e. temperatures) from some type of equipment. "Equipment" refers to a piece of kitchen equipment that implements the protocol as defined in the NAFEM Data Protocol Standard version 3.0. "Packet" refers to data that is sent between the host and the equipment. "List" refers to a document that is provided by the equipment manufacturer to document the specifics elements of the protocol that the equipment supports.

3.0 Protocol Overview

Version 3.0 defines a series of data packets (information passed between a host and the equipment) that provide mandatory and optional data elements to communicate

status and commands between the piece of equipment and host computer. There are two mandatory packets (Equipment Identification Packet and Equipment Output Data Packet) and two mandatory lists (Equipment Packet List and Equipment Parameter List) that the equipment must support. There are three optional packets (Host Command Packet, Equipment Configuration Packet and Response Packet) that a manufacturer may choose to support.

The information included in the Equipment Packet List and Equipment Parameter Lists must be utilized to determine what capabilities (i.e. which Packets are supported and what parameters are available via the communications interface) a particular piece of equipment supports.

Data passed in the packets is encoded using the ISO/IEC 8859-15:1999 standard with the addition of C0 control codes. This standard is very similar to the well known ASCII standard and most of the common English characters have the same codes.

4.0 Equipment Packet List Document (Mandatory)

The Equipment Packet List is a document provided by the equipment manufacturer that provides a summary of the packet types that the equipment supports. This document will be used to determine which packets are supported by the equipment and how to configure the communication packets.

The manufacturer is required to provide this list with the equipment and/or to post it on their website.

5.0 Equipment Parameter List Document (Mandatory)

The Equipment Parameter list is a document provided by the equipment manufacturer that provides a summary of the data available from the Equipment for each type of packet. This document will be used to interpret how the data values sent to or received from the equipment shall be understood, including scaling, units, etc. The document also describes the Manufacturer ID and which revisions of the Equipment firmware support each packet definition.

The manufacturer is required to provide this list with the equipment and/or to post it on their website.

6.0 Equipment Identification Packet (Mandatory)

The Equipment Identification Packet identifies the piece of the equipment on the communications network and provides basic inventory information for asset management. The packet consists of an identifying string (EQUIP_ID), category of equipment, manufacturer identifier, manufacturer's serial number and software version identifier.

EQUIP_ID	Category of Equipment (32 characters)	Manufacturer Identifier (10 characters)	Manufacturer Serial Number (30 characters)	Software Version (15 characters)

Table 1- Equipment Identification Packet

The Category of Equipment field should represent the type of equipment. NAFEM recommends the categories listed in the following table:

Dispensing	Refrigeration
Food Preparation	Security System
Frozen Dessert and Beverage	Steamer
Fryer	Temperature Measurement
Griddle/Grill	Timer
Holding Cabinet	Toaster
Hot Beverage	Ventilation
HVAC	Warewashing
Ice Equipment	Waste Systems
Oven	Weighing
Point of Sale	

Table 2- Equipment Categories

The manufacturer identifier is supplied by NAFEM when the manufacturer registers as being NDP compliant; the remaining information in the packet is defined by the manufacturer.

For example, if the piece of equipment is a fryer made by A1 Fryer Company, with serial number 1234567890 and software version 3.00.05, the equipment identification packet should look like:

> **EQUIP_IDFryerøøøøøøøøøøøøøøøøøøøøøøøøøøøøøA1FryerCoø1234567890øøøøøøøøøøøøøøøøøøøøV3.00.05øøøøøøøø**

(Note that the ø symbol above represents the Null character (0x00 hexadecimal) throughout the rest of this document.)

The associated code for “E” is 0x45 (hexadecimal), for “Q” is 0x51, and so on. So the start of the encoded version of the packet, represented in hexadecimal format, will be:

0x45 0x51 0x55 0x49 0x50 0x5F 0x49 …

If the length of data for a particular field is less than the length of the field, such as the Category of Equipment “Fryer”, the remaining field must be filled with the Null character. Likewise, if manufacturer defined data such as serial number contains more characters than what is allowed for by the packet definition, the data will need to be truncated to fit the allotted length. See the full V3.0 specification for more detail on which fields require Null padding and which require other padding.

The Equipment Identification packet needs to be broadcast when the equipment is powered on (if allowed for in the communication methodology) and provided when queried by the host.

7.0 Equipment Output Data Packet

The Equipment Output Data packet provides information about the transmitting piece of equipment. This packet can be broadcast at any time by the equipment or sent in response to the host command packet, if implemented. The packet contains four fields: an identifying string “DATA_PKT”; Parameter Number, or identity of the data being transmitted; the length of the data being returned; and the data or parameter value.

DATA_PKT	Parameter Number (3 characters) as defined in the Equipment Parameter List Document	Data Length (3 characters)	Parameter Value (1-255 characters)

Table 3- Equipment Output Data Packet

Like the Equipment Identification Packet, the Equipment Output Data Packet begins with a string, which is the packet identifier (DATA_PKT). The next field, Parameter Number references the Equipment Output Parameter List which must be provided by the manufacturer. Following the Parameter Number is the Data Length. Data Length is 3 numeric characters (digits 0-9) representing the length (i.e. number of characters) that will be transmitted in the Parameter Value field. The Parameter Value field represents the actual value of the Parameter.

An example of a freezer temperature of -11.3°F as parameter #13 being returned as an unscaled value from the Equipment might look like:

DATA_PKT013005-11.3

8.0 Host Command Packet (Optional)

The Host Command Packet is intended to provide a method for the host to request certain actions from the equipment. In general, the response from the equipment will be the transmission of a packet from the equipment to the host. The packet contains four fields: an identifying string “CMD_PKT”; Password (8 characters that the equipment utilizes for authentication); Command ID (2 characters) that defines the command to be executed by the equipment; and Command Qualifier (3 characters) that is Command ID dependent.

CMD_PKT	Password (8 characters)	Command ID (2 characters; reference the NDP Standard 3.0 for details)	Command Qualifier (3 characters; reference the NDP Standard 3.0 for details)

Table 4- Host Command Packet

As an example, the Host could query the Equipment with a host command packet using Command ID set to 01 (Send Equipment Identification Packet) and an appropriate password of 0123.

CMD_PKT0123ø ø ø ø01000

Then, if the password is correct, the Equipment responds by sending the Equipment Identification Packet to the Host, described above.

9.0 Equipment Configuration Packet (Optional)

The Equipment Configuration Packet enables the host to configure writable parameters within the equipment. Examples could be temperature settings or cooking times. The packet contains five fields: an identifying string “CONFIG_PKT”; Password (8 characters that the equipment utilizes for authentication); Configuration ID (3 characters) that defines the configuration parameter, as identified in the Equipment Parameter List Document; Data Length (3 characters) that defines how many characters of data are in the Configuration Value; and Configuration Value (variable size of 1-255 characters, as defined in the Data Length field).

CONFIG_PKT	Password (8 characters)	Configuration ID (3 characters)	Data Length (3 characters)	Configuration Value (1-255 characters)

Table 5- Equipment Configuration Packet

As an example, the Host wants to configure a fryer temperature set point of 325.4°F. The Equipment Parameter Lists describes that set point as having a Parameter ID of 2,

no scaling, and only accepting integer values. So the Equipment Configuration Packet might look like:

CONFIG_PKT0123øøøø002003325

Note that since the equipment can only accept integral values for this set point, the .4 has been truncated and is not sent to the Equipment.

Also note that if the Equipment Configuration Packet is implemented, then the Response Packet, described below, must also be implemented on the Equipment.

10.0 Response Packet (Optional)

If the Equipment Configuration Packet is implemented, then the Response Packet must be sent from the Equipment after the successful reception of the Equipment Configuration Packet. The Response Packet is used to allow the equipment to provide an indication to the host as to whether the Equipment Configuration Packet was successful or not. The packet contains two fields: an identifying string "RESPONSE_PKT"; and Response Code (2 characters).

RESPONSE_PKT	Response Code (2 characters; reference the NDP Standard 3.0 for details)

Table 6- Response Packet

Using the set point example above, if the new set point is accepted by the Equipment, the Host would receive back a packet like:

RESPONSE_PKT00

To indicate the packet was successfully processed and there were no errors, the two-character Response Code is 00. Other codes are defined by the standard, reserved for use, or defined by the equipment manufacturer. See the NDP Standard 3 for more details and other supported Response Codes.

11.0 Interaction Flowchart

The following diagram shows a typical interaction between the Host and Equipment. In this example, the Host needs information about the equipment (i.e. serial number). The host initiates the transaction by sending a Host Command Packet to the Equipment with the Command ID set to 01 (Send Equipment Identification Packet). The Equipment receives and processes this request. The Equipment then sends an Equipment

Identification Packet back to the Host. The Host receives the packet which includes the serial number for the equipment. Other interactions (i.e. host requesting a data packet, etc.) would be performed in a similar manner.

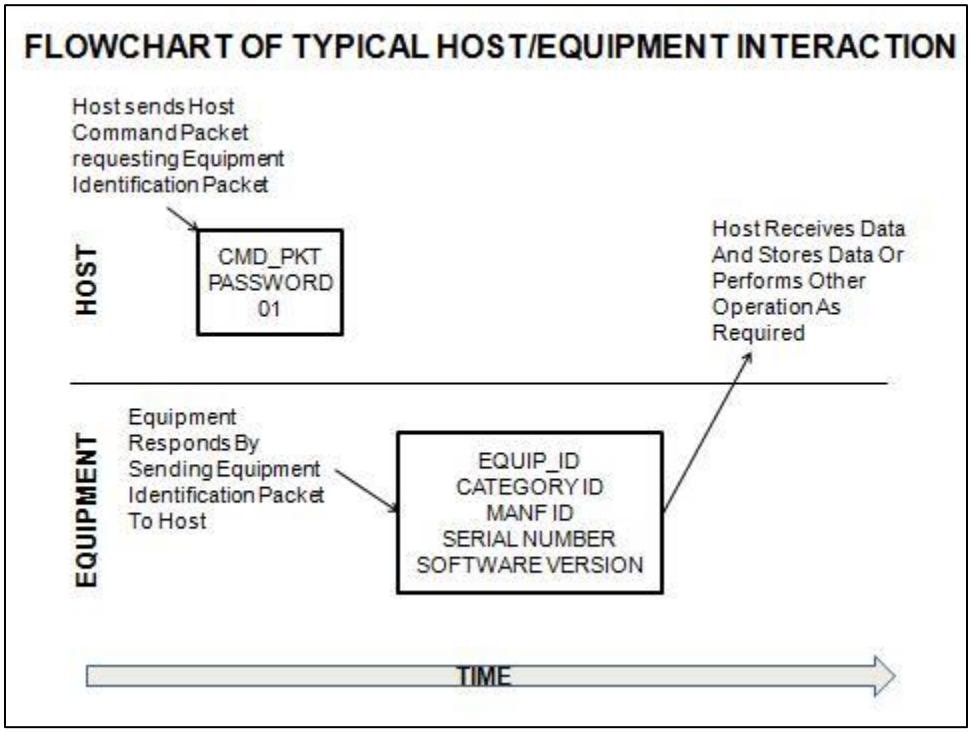

Figure 1- Flowchart Of Host/Equipment Interaction

Using the example above of the A1 Fryer Co., the Host would send the following 20 ISO/IEC 8859-15 characters:

CMD_PKT0123ø@@@01000

Then the Equipment would respond with the following 95 characters, including Null padding:

EQUIP_IDFryerø@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@A1FryerCoø1234567890@@@@@ø@@@@@@@@@@@@@@@@V3.00.05@@@@@@@

The Host would then process the EQUIP_ID data however was appropriate for the Host system.

12.0 Summary

This application note has addressed the general method for communication between a host and equipment using the NAFEM Data Protocol Version 3.0. All communications between the host and equipment utilize the general structure as defined in this document. Protocol specific (i.e. Ethernet, Modbus, LonWorks, ZigBee, etc.) application documents are being developed and will utilize the general structure as defined in this document to show how the implementation would be performed using different communication protocols. Refer to the NAFEM website for additional details and updates.