

MEA-2x00 and the AFP Network Protocol

Description

This application note describes the structure of the AFP NETWORK PROTOCOL and provides example communications using the AFP_CLIENT utility software.



AFP Network Protocol

AFP continues to expand its portfolio of precision valves and fluidic control products, many of which incorporate embedded microcontroller technology for advanced control, configuration, and diagnostics. During manufacturing, these products are configured and tested to ensure reliable performance. Once deployed, they can be controlled through either digital inputs or serial communication, depending on the application requirements.

This document focuses on the serial communication architecture used across AFP's microcontroller-based product portfolio. Because multiple electronic devices may operate within the same system—including different AFP products such as the MEA-2000, MEA-2100, and EDV—AFP has developed a multi-device communication protocol that enables efficient control of multiple units on a single network. The protocol also provides cross-product compatibility, allowing different AFP electronic products to communicate using a common, standardized interface.

Technical Description

- RS-232 can be used in single user system
- RS-485 "Half-Duplex" is used for multi user system
- USB 2.0 can be used in single user system
- Each user has an I.D. number from 01 to 89
- Variable return for each function to accommodate simple terminal command or complex application software
- Function number from 001 to 255

Protocol Features

- Protocol Features :
- Multi user
- Compatibility between AFP products family
- Easy to use text command (ASCII)
- Well documented
- AFP_CLIENT utility software for protocol demonstration and hardware configuration.
- Different return parameter to confirm command execution
- Adaptable to human input command and fast machine to machine bidirectional communication

AFP NETWORK COMMAND FORMAT

An AFP network command is made of fixed and optional sections.

UXXCMD	_Y_	&ZZZ	=	Parm1	,	Parm2	,	Parmn	Cr	Lf
I.D. Number	Return Parameter	Command Number	=	Data	,	Data	,	Data	(10)	(13)
Command			Command						/r	/n

XX	ASCII	I.D. Number	00..99
Y	ASCII	Return parameter	A..Z
ZZZ	Numerical	Command Number	001..255
Parm1	ASCII	Parameter no.1	DATA
Parm2	ASCII	Parameter no.2	DATA
Parmn	ASCII	Parameter no.n	DATA

Command Number

A 3-digit numerical format will specify the command number. There are some general commands that all AFP products will answer and some specific ones for the EDV, MEA-2000 and the MEA-2100. Even if a command is not supported, all products will answer to a command reducing timeout period.

Command Parameter

When data need to be send in a command it is added after a separation character “=”. If more parameters are needed (Parm1, Parm2, Parmn) they are separated by comma “,”.

Return Parameter

The return parameter controls the answer format. In terminal utilization, there is no need to add extra character. In software process, it is preferable to add acknowledge and checksum to confirm the communication. Adding the ID number in the answer helps monitoring in the multi user application.

The return parameter is a single ASCII character padded by 2-underscore character “_Y_”

Return Parameter List

- A ==> NO RESPONSE (USED IN BATCH)
- B ==> RXX_&ZZZ_Y: + ANSWER IN ASCII + CHECKSUM(5) + 13, 10
- D ==> RXX_&ZZZ_Y: + ANSWER IN ASCII + 13, 10
- F ==> RXX_&ZZZ_Y: + ANSWER IN ASCII
- H ==> ANSWER IN ASCII + 13,10
- J ==> ANSWER IN ASCII
- W ==> RXX_&ZZZ_Y: + ANSWER IN ASCII + 13, 10

SPECIAL ANSWER TO HELP MEA ACTUATION. THE RESPOND IS THE POSITION, NUMBER OF PORT AND VALVE MODE TYPE

Checksum(5): ASCII of adding all character starting after the two dots “:” (00000 to 65536)

RETURN FORMAT

UXXCMD	&ZZZ	_Y_	:	PAYLOAD,	CHECKSUM(5)	Cr	Lf
I.D. Number	Command Number	Return Parameter	:	Data	(0-65536)	(10)	(13)
Command					Optional	/r	/n

ACK or _NAK_ are common communication answer. When a command does not wait for any data, only _ACK_ or _NAK_ is part of the return payload. Data replace _NAK_ and _ACK_ when available followed by an optional checksum.

When extended answer is request the return DATA start after the two dots “:”

The first part of the answer is form from the command request. On the network, any user or application software can read answers and know from where and which format it is made of.

Checksum(5): ASCII of adding all Payload characters stating after the two dots “:” (00000 to 65536)

Command Examples

SET CONTROL MODE TO SERIAL

(I.D. = 01, Command number = 010, Return Parameter = “H”)

SERVER: U01CMD_H_&010=MODE,SERIAL(13)(10)

AFP: _ACK_(13)(10)

SET CONTROL MODE TO SERIAL (see return format)

(I.D. = 01, Command number = 010, Return Parameter = “D”)

SERVER: U01CMD_D_&010=MODE,SERIAL(13)(10)

AFP: R01_&010_D:_ACK_(13)(10)

GET CONTROL MODE

(I.D. = 01, Command number = 110, Return Parameter = “H”)

SERVER: U01CMD_H_&110(13)(10)

AFP: SERIAL(13)(10)

GET CONTROL MODE (see return format)

(I.D. = 01, Command number = 110, Return Parameter = “D”)

SERVER: U01CMD_D_&110(13)(10)

AFP: R01_&110_D:SERIAL(13)(10)

COMMAND LIST

Digital Input / Output Description		
GET		
Number	Name	Secondary Protocol
110	Get Control mode (Serial or Digital)	
114	Get Selection mode (1 or 2 digital input)	
115	Get number of port	NP
118	Get polarity in digital mode	
119	Get torque/speed mode	
120	Get secondary protocol	
224	Get Output	
124	Get serial number	
128	Get product name	
129	Get product information	
181	Get actuator counter (actuation)	CNT
182	Get actuator counter (number of BOOT)	
183	Get actuator counter (number of configuration, stop finding MEA-2000)	
184	GOTO service position "flat"	AL
226	Set output	
225	Get output	MEA6
ACTUATION		
217	Get Last Actuation Time (MS)	TM
221	Get Actual port position	CP
223	Selection function (GOTO position 1 to 16)	GO (A or B)
221	Get Actual port position	CP
232	Toggle position	TO
234	Goto (Home position)	HM,AL
235	Goto position 2 (ccw)	CC
SYSTEM INFORMATIONS		
250	Parm1=1 Get MEA-2x00 user information	/?
250	Parm1=2 Get MEA-2x00 configuration information	
250	Parm1=3 Get MEA-2x00 secondary protocol information	
OTHER (Secondary Protocol) SET		
X	Set actuation counter	CNTnnnnn
X	Set ID of the actuator	ID/
X	SET ID to none (back to single user)	*ID*
X	Set actuator mode (answer 1 MEA-2000, answer 3 for MEA-2100)	AM n
X	Toggle the actuator to the opposite position	TO
X	SET the response mode (0 or 1)	FM n
X	Fixed to mode	0 LG
X	Set valve stopper (disable, use Config button)	LRN
OTHER (Secondary Protocol) GET		
X	Get Status	STAT
X	Display the current baud rate (MEA-2x00 fixed at 9600,N,8,1)	SB
X	Display actuator counter	CNT
X	Display actual position	CP
X	Display actuator mode (answer 1 for MEA-2000, answer 3 for MEA-2100)	AM
X	Display MEA-2000 information n=none or n=2	VRn
X	Display number of port MEA-2000 fixed to 2	NP

COMMAND DESCRIPTION

Command Number	009			
Command Name	Set MEA ID			
UXXCMD_Y_&009	=	Parm1	(13)	(10)
Parm1	01 to 89			
Value	New ID number			
Command Number	010			GET: 110
Command Name	Set Control Mode			
UXXCMD_Y_&010	=	Parm1, Parm 2	(13)	(10)
Parm1	1 or 3			
Value	MODE,SERIAL			
Value	MODE,DIGITAL			
Command Number	013			GET: 113
Command Name	Set Mea Mode			
UXXCMD_Y_&013	=	Parm1, Parm 2	(13)	(10)
Parm1	1 or 3			
Value	MEA_MODE,1 for 2 positions			
Value	MEA_MODE,3 for multi positions			
Command Number	014			GET: 114
Command Name	Set Selection Mode			
UXXCMD_Y_&014	=	Parm1, Parm 2	(13)	(10)
Parm1	1 or 2			
Value	MODE,1 FOR 1 INPUT OR MODE,2 for 2 INPUTS in DIGITAL control mode			
Command Number	015			GET: 115
Command Name	Set Number Of Port			
UXXCMD_Y_&015	=	Parm1	(13)	(10)
Parm1	NUMBER OF PORT (note that for 2 positions MEA-2000 the value is fixed to 2 positions)			
Value	04, 08, 16 (2-digit left-justified)			
Command Number	017			GET: 117
Command Name	Set Default Rotation For Step Multi Position Digital Actuation			
UXXCMD_Y_&017	=	Parm1	(13)	(10)
Value	F or R			
Value	F (default) for CCW/UP or R for CW/DOWN position			
Command Number	018			GET: 118
Command Name	Set Digital Polarity Input			
UXXCMD_Y_&018	=	Parm1, Parm 2	(13)	(10)
Parm1	NEGATIVE TRUE (close contact) or POSITIVE TRUE (open contact)			
Value	MODE,1 (default) or MODE,2 will reverse the actuation			
Command Number	019			GET: 119
Command Name	Set Torque Mode			
UXXCMD_Y_&019	=	Parm1, Parm 2	(13)	(10)
Parm1	TORQUE/SPEED			
Value	MODE, 1 or 2 1: HIGH TORQUE / MID SPEED 2: MID TORQUE / HIGH SPEED			

COMMAND DESCRIPTION

Command Number	020		GET: 120
Command Name	SET SECONDARY PROTOCOL		
UXXCMD_Y_&020	=	Parm1	(10)
Parm1	MEA-2000 and MEA-2100 response to popular protocol on the market		
Value	0: AFP only 1: AFP and secondary 2: (Default) AFP and secondary (but no invalid command)		
Command Number	024		GET: 124
Command Name	Set Serial Number		
UXXCMD_Y_&024	=	Parm1,	(10)
Parm1	Serial Number		
Value	10 Alpha numeric characters		
Value	Can be done only once		
Command Number	026		
Command Name	Set Mea Mode		
UXXCMD_Y_&026	=	Parm1,	(10)
Parm1	Send to Terminal Real Time Actuation Data		
Value	0: (Default at power up) No real time information 1: real time information		
Command Number	028		GET: 128
Command Name	SET PRODUCT NAME		
UXXCMD_Y_&028	=	Parm1,	(10)
Parm1	Product Information		
Value	10 Alpha numeric characters		
Command Number	029		GET: 129
Command Name	Set Product Information		
UXXCMD_Y_&029	=	Parm1	(10)
Parm1	Product Information		
Value	10 Alpha numeric characters		
Command Number	080		GET: 180
Command Name	Reset Actuation Counter		
UXXCMD_Y_&080	=	Parm1	(10)
Value	ZERO: reset counter		
Value	ZERO		
Command Number	095		
Command Name	GOTO Install or Flat Position		
UXXCMD_Y_&095		(13)	(10)
Command Number	225		
Command Name	Get Digital TTL Input		
UXXCMD_Y_&225		(13)	(10)
Command Number	217		
Command Name	GET LAST ACTUATION TIME xxxx (ms)		
UXXCMD_Y_&217		(13)	(10)
Command Number	221		
Command Name	GET ACTUAL PORT POSITION		
UXXCMD_Y_&221		(13)	(10)

COMMAND DESCRIPTION

Command Number	223					
Command Name	SET SECONDARY PROTOCOL					
UXXCMD_Y_&223	=	Parm1	Parm2	(13)	(10)	
Parm1	Port Number					
Value	01 or 02 for 2 positions for MEA-2000, 1 to 16 for MEA-2100					
Parm2	Forced Rotation CW / CCW or shortest route					
Value	1: CW or 2: CCW or 3: Shortest					
Command Number	224					
Command Name	GET DIGITAL OUTPUT TTL LEVEL					
UXXCMD_Y_&224	=		(13)	(10)		
Result	X,X (input1,input2)					
Command Number	226					GET: 224
Command Name	SET DIGITAL OUTPUT TTL LEVEL					
UXXCMD_Y_&226	=	Parm1	,Parm2	,Parm3	(13)	(10)
Parm1	0 = Control by the MEA-2000 to show it position on digital output					
Parm2	0 = output1 to 0 Volt 1 = output1 to 5 Volts@10 mA					
Parm3	0 = output2 to 0 Volt 1 = output2 to 5 Volts@10 mA					
Command Number	232					
Command Name	ACTUATION == MEA-2000 2 position TOGGLE POSITION					
UXXCMD_Y_&232	=	Parm1,	(13)	(10)		
Command Number	233					
Command Name	ACTUATION == MEA-2100 Multi position STEP+1					
UXXCMD_Y_&233	=	Parm1	(13)	(10)		
Command Number	234					
Command Name	ACTUATION GOTO HOME POSITION == PORT NO.01					
UXXCMD_Y_&234	=	Parm1	(13)	(10)		
Command Number	235					
Command Name	ACTUATION == MEA-2100 Multi position STEP-1					
UXXCMD_Y_&235			(13)	(10)		

INSTRUCTIONS

Using AFP_CLIENT

AFP AFP_CLIENT ver 1.3

COM Serial Port Settings

COM Port:

COM8

Baud Rate:

9600

Parity:

None

Data Bits:

8

Stop Bits:

One

☒ Open

☐ Close

I.D. Number

01

Changing the Control Mode

Command Number:010

Parameter: MODE,SERIAL

Parameter: MODE,DIGITAL

Control Mode (010)

MODE,SERIAL

Changing The Control Mode Using The Command Editor:

Command Number:010

Parameter: MODE,SERIAL

Parameter: MODE,DIGITAL

```
U01CMD_H_4010=MODE,DIGITAL
_ACK_
```

AFP Protocol Command Editor

I.D.:

01

Return Param:

H

Function No:

010

Function Parameter:

=MODE,DIGITAL

Send Command + CR LF

Actuation Using Both Protocols

1. Press the Show MEA Status button to give MEA-2100 informations to the AFP_CLIENT utility software.
2. Use both side (AFP and Secondary) for actuation in both protocol
3. Check and Un-check the "Used secondary protocol" and see in the terminal windows the different command format using the GOTO button.

The screenshot shows the MEA-200 BOOTLOADER interface. At the top, there's a 'MEA Model' section with two radio buttons: 'MEA-2000 TWO Positions' (unselected) and 'MEA-2100 MULTI Positions' (selected). A 'Show MEA Status' button is to the right. Below this is the 'AFP' section with a 'Get Actual Position' button and a 'CMD_221' button. To the right is the 'Secondary' section with a 'CP' button. In the center, a large '03' is displayed. Below the AFP section is the 'One Port Actuation' section with three buttons: 'CMD_233' (GOTO Position +1), 'CMD_234' (GOTO To HOME Position), and 'CMD_235' (GOTO Position -1). To the right of these are 'CW', 'HM', and 'CC' buttons. At the bottom is the 'MEA Position GOTO Actuation' section with a 4x4 grid of buttons numbered 1 to 16. Buttons 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16 are all unselected. To the right of the grid are three radio buttons: 'Goto Position CW' (unselected), 'Goto Position CCW' (unselected), and 'Goto Position "Shortest"' (selected). Below these is a checkbox labeled 'Used secondary Protocol' which is checked. Green arrows point from the 'Show MEA Status' button to the '03' display, from the '03' display to the 'GOTO Position +1' button, and from the 'Used secondary Protocol' checkbox to the 'Goto Position "Shortest"' radio button.