FMC Technologies

Electronic Preset Controller

Smith Meter® microFlow.net™ Gas

Communications

Issue/Rev. 0.0 (6/11)

Bulletin MNFG004

microFlow.net

Caution

The default or operating values used in this manual and in the program of the microFlow.net Gas are for factory testing only and should not be construed as default or operating values for your metering system. Each metering system is unique and each program parameter must be reviewed and programmed for that specific metering system application.

Disclaimer

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Proprietary Notice

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Section I – Introduction

This manual fully describes how the Smith Meter® microFlow.net Gas Electronic Preset communicates with other computing devices from a simple dumb terminal to a large computer.

Incorporated within the microFlow.net Gas is the ability to communicate directly (i.e., without a modem or multiplexer) with an EIA 232C, EIA 485, and/or Ethernet compatible remote terminal or minicomputer. Depending on the communication type, certain key information from multiple microFlow.net Gas' can be requested (polled).

To communicate with a particular microFlow.net Gas unit, the following communication Program Codes involving type, mode, address, and configuration must be specified for that particular unit as shown in the chart below.

For Serial Port Communications:

System Program Codes 701 - 718			
Port 1	**Port 2**	**Port 3**	
701	707	713	Function
702	708	714	Baud
703	709	715	Data/Parity
704	710	716	Control
705	711	717	Time-out
706	712	718	Mode (RS232/485)

For Ethernet and SLIP Communications:

System Codes	
722	Netmask
723	Gateway
724	Ethernet Host Control
726	Ethernet Time-out

For Both Types of Communications:

System Codes	
721	microFlow.net Gas unit Address (x.x.x.1 – x.x.x.99-serial; valid IP address-Ethernet)
725	Comm Link Programming (Level of Access)

For Modbus Communications:

Communications	
727	Modbus Endian

Serial Communications

Samuel F.B. Morse's dot-dash telegraph code is the earliest example of a practical, time sequential, data-coding scheme for transmission of information by communication equipment. This code is considered the predecessor of the ones and zeros modern digital communication codes now used for serial data transmission of time sequenced information over a pair of wires.

Similar to Morse Code, digital codes provide a means of representing numbers, letters of the alphabet, or other special characters in a digital information system. A digital code is a pattern of binary digits or bits, zeros and ones arranged in a particular fashion. The most familiar code used for arithmetic computations in digital systems is the Binary Coded Decimal, commonly known as BCD code. The BCD code is a weighted code in that a numerical weight is assigned to each bit position in the code. Using a four-bit BCD code for an example, the left-most bit has a numeric weighted value of 8, the next bit has a numeric weighted value of 4, the next to the last bit a weight value of 2 and the last bit, a value of 1. The total value of the coded number is equal to the sum of the numerical weights of the bits represented by the binary digit 1. Four-bit BCD codes are valid only for numbers between 0 and 9. For example, the number 3 is represented by a BCD code of "0011," and the number 9 is "1001." To represent 39, the respective BCD code is "0011 1001."

There are many different codes used to perform specific tasks in digital systems, but the one code most widely used in digital communications systems is the American Standard Code for Information Interchange, or simply ASCII code. Like other binary codes, the ASCII code is a weighted code.

The ASCII code is a more complex code than BCD since it uses patterns of seven bits to represent 128 characters consisting of either upper or lowercase letters of the alphabet, punctuation characters, and control characters in addition to numbers. For example, the ASCII code representation of the number 39 is "0110011 0111001." A complete ASCII code character table is shown in *Table 1*.

ASCII Code Table

ASCII CHARACTER	DECIMAL	HEX	BINARY
NUL	0	0	000 0000
STX	2	2	000 0010
ETX	3	3	000 0011
LF	10	A	000 1010
CR	13	D	000 1101
SP	32	20	010 0000
!	33	21	010 0001
"	34	22	010 0010
#	35	23	010 0011
$	36	24	010 0100
%	37	25	010 0101
&	38	26	010 0110
'	39	27	010 0111
(	40	28	010 1000
)	41	29	010 1001
*	42	2A	010 1010
+	43	2B	010 1011
,	44	2C	010 1100
-	45	2D	010 1101
.	46	2E	010 1110
/	47	2F	010 1111
0	48	30	011 0000
1	49	31	011 0001
2	50	32	011 0010
3	51	33	011 0011
4	52	34	011 0100
5	53	35	011 0101
6	54	36	011 0110
7	55	37	011 0111
8	56	38	011 1000
9	57	39	011 1001
:	58	3A	011 1010
;	59	3B	011 1011
<	60	3C	011 1100
=	61	3D	011 1101
>	62	3E	011 1110

ASCII CHARACTER	DECIMAL	HEX	BINARY
?	63	3F	011 1111
@	64	40	100 0000
A	65	41	100 0001
B	66	42	100 0010
C	67	43	100 0011
D	68	44	100 0100
E	69	45	100 0101
F	70	46	100 0110
G	71	47	100 0111
H	72	48	100 1000
I	73	49	100 1001
J	74	4A	100 1010
K	75	4B	100 1011
L	76	4C	100 1100
M	77	4D	100 1101
N	78	4E	100 1110
O	79	4F	100 1111
P	80	50	101 0000
Q	81	51	101 0001
R	82	52	101 0010
S	83	53	101 0011
T	84	54	101 0100
U	85	55	101 0101
V	86	56	101 0110
W	87	57	101 0111
X	88	58	101 1000
Y	89	59	101 1001
Z	90	5A	101 1010
[	91	5B	101 1011
\	92	5C	101 1100
^	94	5E	101 1101
_	95	5F	101 1111
`	96	60	110 0000
A	97	61	110 0001
B	98	62	110 0010
C	99	63	110 0011
D	100	64	110 0100
E	101	65	110 0101

ASCII CHARACTER	DECIMAL	HEX	BINARY
F	102	66	110 0110
G	103	67	110 0111
H	104	68	110 1000
I	105	69	110 1001
J	106	6A	110 1010
K	107	6B	110 1011
L	108	6C	110 1100
M	109	6D	110 1101
N	110	6E	110 1110
O	111	6F	110 1111
P	112	70	111 0000
Q	113	71	111 0001
R	114	72	111 0010
S	115	73	111 0011
T	116	74	111 0100
U	117	75	111 0101
V	118	76	111 0110
W	119	77	111 0111
X	120	78	111 1000
Y	121	79	111 1001
Z	122	7A	111 1010
{	123	7B	111 1011
∠	124	7C	111 1100
}	125	7D	111 1101
•	126	7E	111 1110
DEL	127	7F	111 1111

Table 1

A computer system always requires some digital data transmission between its various parts: CPU to peripherals, CPU to memory, or memory to peripherals. Data transmission to and from these devices must conform to some accepted standard. To date, the only widely used transmission standards deal with serial digital data. There are essentially three organizations that issue standards that define serial digital communication interface circuits, their electrical and timing characteristics, the manner in which they operate, and the mechanical details of the appropriate connectors. These organizations are the Electronics Industries Association (EIA), the International Consultative Committee for Telephony and Telegraphy (CCITT), and the International Standards Organization (ISO).

EIA Standard, EIA 232 (formerly known as RS 232) is the most popular serial interface standard. This standard is extensively used by terminals, data sets, measuring instruments, and controllers for data transmission rates up to 20,000 bits per seconds for transmission cables up to 50 feet in length. EIA 232 is a single-ended voltage mode transmission system standard that defines data communication between equipment using alternating pulses which can be in one of two states – either high (logic 1) or low (logical 0). These states are often called “mark” (logic 1) or “space” (logic 0). According to EIA, the logical 1 level must be within +3.75 to +25 volts DC, while the logical 0 level must be within -3.75 to -25 volts DC. Any other voltage levels are unacceptable according to EIA standards.

EIA 232 is not the only serial interface standard or system. EIA 422, 485 and 20mA current loop are among the newer long-distance current mode digital communication standards. The current mode standards are better suited for longer distance, higher speed communications than its voltage mode predecessors. Although not a revolutionary concept, the current mode system dates back to the oldest form of binary serial transmission: the telegraph. In this system a current, usually 20mA, flows through a single loop to represent a logic level one, and turns off, “open key” to represent logic zero.

Serial data is typically transmitted among or between devices in an asynchronous fashion. In asynchronous data transmission, each transmitted character is formed by using a start bit which signals the beginning of the character before the ASCII code pattern, and one or two stop bits after the code pattern signaling the end of the character. The ASCII character is described fully by seven bits with an optional parity bit in the eighth position for error control. Therefore each transmitted ASCII character requires at least ten bits for complete definition. As the communication equipment receives the asynchronously transmitted characters, the start and stop bits are stripped off, parity is checked, and the character itself is interpreted and treated according to whether it is alphanumeric data or control information.

“Baud rate” and “bit rate” are two distinct terms used to describe the speed of data transmission. These terms are often used synonymously and cause much confusion if not completely understood. The baud is a measurement unit dating back to the days of Morse Code, and it is defined as the shortest signaling element. In modern telecommunications language, the data rate is more often specified in bits per second (bps), because a single change of state in a signal can represent a group of two or more data bits. If each signal event represents only one bit condition, baud rate equals bps. Typical asynchronous serial baud rates are 1200, 2400, 4800, 9600, 19200, and 38400 bps. To have an interactive session between two computing devices, both of the devices must be transmitting and receiving at the same baud rate, or there must be an intermediate memory device, called a buffer, that accommodates the differences in speed. Refer to the microFlow.net Gas installation manual to determine the appropriate baud rate based on cable length for each unique installation site.

Ethernet and TCP/IP Communications

The proliferation of personal computing beginning in the 1970s gave rise to the need to interconnect groups of computers for the purpose of sharing data, peripheral devices (printers, modems…) and now instruments. The most popular of these groups are known as Local Area Networks (LANs). These networks consist of nodes, where computers, peripherals and instruments are connected to the network, and interconnecting wire or fiber optic cable to interconnect the nodes. A LAN can consist of a few nodes up to several hundred but will be confined to a few buildings within a few thousand meters of one another. Technologies were developed to establish standard interface hardware as well as secure control of the flow of data on the LAN. Ethernet emerged as the primary medium for LANs. The Ethernet technology equipment; interface cards, hubs, switches, and cabling have become commodity items. Software protocols were developed to standardize sharing and transfer of files, mail messages, access to peripherals, and access to the internet. Again a primary standard has emerged in the TCP/IP protocol. The acronym TCP/IP comes from two protocols developed for the internet; Transmission Control Protocol and Internet Protocol.

The microFlow.net Gas can be connected to a TCP/IP LAN using the Ethernet port; or it can be networked in a point-to-point configuration via one of the serial ports using the SLIP protocol.

Communications for Terminal Mode of Operation

The microFlow.net Gas System Program Code Communications Port Function must be set to Terminal Host. This character-oriented protocol uses the ASCII character "*" to define the start of a message and Carriage Return – Line Feed (CR-LF) characters to terminate the message. No error checking other than parity on each character is performed.

The message format is:

*	A1 A2	text	CR	LF

for an instruction to microFlow.net Gas, or

*	A1 A2	text	CR	LF

for a response from microFlow.net Gas

Where:

*	=	Asterisk Hex "2A"
Text	=	Character string containing instructional or response information
CR	=	Carriage return Hex "0D"
LF	=	Line feed Hex "0A"
A1 A2	=	microFlow.net Gas Address (01 to 99)

The universal or global address "00" is an invalid address and must not be assigned to any microFlow.net Gas. The address, A1 A2, always consists of two ASCII characters.

Data is formatted using ASCII characters and each character frame consists of 1 start bit, 7 or 8 data bits, none, even or odd parity, and 1 or 2 stop bits. A maximum communication rate of 38,400 baud is supported. There is no echo back of received characters by the microFlow.net Gas in the Terminal Mode of operation.

Note: *Via an established Ethernet or SLIP connection, this protocol is always available via port 7734.*

Communications for Minicomputer Mode of Operation

This character-oriented protocol uses the transmission control character STX to define the start of a message, and ETX to terminate the message. A Longitudinal Redundancy Check (LRC) character follows the ETX character for additional message error detection beyond the traditional parity check done on each transmitted character.

The message format is:

STX	A1 A2	text	ETX	LRC

for an instruction to microFlow.net Gas, or

NL	STX	A1 A2	text	ETX	LRC	PAD

for a response from microFlow.net Gas

Where:

NL	=	Null character Hex “00”
STX	=	Start of Text Hex “02”
Text	=	Character string containing instructional or response information
ETX	=	End of Text Hex “03”
LRC	=	Longitudinal Redundancy Check
PAD	=	Pad character Hex “7F”
A1 A2	=	microFlow.net Gas Address (01 to 99)

The LRC is an ASCII character computed as the exclusive OR (XOR) sum of all characters following the STX and including the ETX transmission control characters.

The universal or global address “00” is an invalid address and must not be assigned to any microFlow.net Gas. The address, A1 A2, always consists of two ASCII characters.

Data is formatted using ASCII characters and each character frame consists of 1 start bit, 7 or 8 data bits, none, even or odd parity, and 1 or 2 stop bits. There is no echo back of received characters by the microFlow.net Gas in the Minicomputer Mode of communications.

Text Format

Command and Response text will be shown enclosed in single quotes. Embedded spaces are represented by an underscore character (_). Any other character representation will be described where used.

An “OK” is used in response to any action type command that has been successfully carried out. For request only commands, a good response will report the data requested in the format shown for that command.

A “NOXX” (XX represents a two character code) is used to show that the command has been rejected. The two-character code represents the condition causing the rejection. For an expanded description of these codes, see “Appendix II.”

Time-out, or no response received from the microFlow.net Gas, occurs when the command string has been entered incorrectly. The communicating program should set an upper limit on the amount of time it will wait for a response from any microFlow.net Gas, and register a time-out when that time has elapsed, to prevent a bad command from locking up the communications. Commands must be formatted exactly as stated. Invalid addresses, incomplete data, and excess data are all causes for this to occur. A more detailed explanation follows:

Invalid Address – An microFlow.net Gas will ignore a command whose address does not match its own. The communication address is programmed into the microFlow.net Gas System program code 721. For serial communications, the last octet of the four octet IP address is used.

Incomplete Data – The code format for each communication command is stated in the Command Reference Guide section. If any portion of the command is left out, a time-out will occur.

Excess Data – Commands must be formatted exactly as stated. No excess data may be inserted or added.

Communication Control Selections

The amount of control that the communicating device has over the microFlow.net Gas is programmable for various degrees of control.

Poll and Program – Identical to “Polling Only” and adds programming privilege, but excludes authorizing privilege.

Host Control – Permits the EIA-232, EIA-485 or Ethernet communication device to request information and to authorize operation, or to have complete control over all operations.

XON/XOFF – Printer security protocol, designed to keep the printer buffer from overflowing. The printer sends an XOFF(13 hex) when the print buffer is nearly full. The microFlow.net Gas stops sending data until the printer sends an XON (11 hex) signifying that it is ready for more data.

PTB-FX – Printer security protocol, designed to guarantee the printer received and printed each line it is sent. Primarily used in European markets.

PTB-LQ – Printer security protocol, designed to guarantee the printer received and printed each line it is sent. Primarily used in European markets.

Each command listed in the Command Reference Guide section of this manual indicates the supporting communication modes.

Section IV – Communications with Smart Additive Injectors

The microFlow.net Gas communicates with the Titan, Gate City Smart Additive, and Smith Smart Additive Systems. After three tries, if there is no response from the additive injector system, an alarm will be set and the microFlow.net Gas will respond to the alarm as it has been instructed to do in the programming.

The microFlow.net Gas controls the Additive Subsystem totally through communications. The additive pacing is by communications, the additive system receives communication commands at the same interval at which the piston injectors would receive a signal to inject. With smart injectors, no incoming pulses are required by the additive injector. Certain parameters must be established in the Additive Subsystem prior to each batch, commands that will have to be issued during the batch and the end of the batch. In all cases, the parameters and commands are only issued to those additive injector systems that have been authorized for use for the current batch.

Command Code AR – Alarm Reset

The AR command causes a currently active alarm to be cleared from microFlow.net Gas. A special alarm code 'AA' will cause all currently active alarms to be cleared. The alarm specified must be active and configured to be reset through communications or the command will be rejected.

Command:

"AR" Reset all alarms in all tables

"AR_XX_SY" Reset specific alarms for the specified injector

Where: XX = Two-character alarm code (see tables below).

Responses:

"OK" Good Response.

or...

"NOXX" The alarm was not reset.

Remarks: The two-character alarm code must be one of those alarms that is allowed to be reset through the communication channel. All alarms except "DA" can be cleared through communications.

Constraints: The alarm code must be able to be reset through communications. If it is allowed, it must be pending or a "NO" will be returned.

Special Case: A special code, "AA," may be used to reset all resettable alarms that are pending in the directory specified.

Comm. Modes: Host Control.

Resettable Alarm Status Codes

Code	Condition
CM	Communications Alarm: Communications failure on one of the communications channels.
DR	Density Transducer: Density transducer failure or out-of-range condition.
HD	High Density: Density transducer is out of range of the high alarm setting.
HF	High Flow Alarm: Flow rate has exceeded limit set by Excess High Flow program code for more than 4 seconds.
HP	High Pressure: Pressure transducer is out of range of the high alarm setting.
HT	High Temperature: Temperature probe or transducer is out of range of the high alarm setting.
LD	Low Density: Density transducer is out of range of the low alarm setting.
LF	Low Flow Alarm: Flow rate was at or below the minimum flow rate established by Low Flow Limit program code for longer than 8 seconds.
LP	Low Pressure: Pressure transducer is out of range of the low alarm setting.
LT	Low Temperature: Temperature probe or transducer is out of range of the low alarm setting.
MO	Mass Meter Overdrive: This alarm is set when a mass meter reports a status indicating a tube imbalance condition exists. (This alarm is valid only for S-Mass.)
MT	Mass Meter Tube: This alarm is set when a mass meter reports a status indicating a tube imbalance condition exists. (This alarm is valid only for S-Mass.)
PA	Power-fail Alarm: The unit either had a power failure or a hardware reset occurred.
PR	Pressure Transducer: Pressure transducer failure or out-of-range condition.
PS	Pulse Security: Used only with the security pulse option. Indicates that an excessive number of out-of-sequence errors in the A-B pulse stream have been detected.
SA	Indicates that excessive flow rate has caused the sampler to miss a sample
SP	Shared printing has failed
TP	Temperature Probe: Short or open condition in the temperature probe circuit.
U1	User Alarm #1
U2	User Alarm #2
U3	User Alarm #3
U4	User Alarm #4
U5	User Alarm #5
UC	Ultrasonic communications has failed
UM	Ultrasonic meter alarm

Resettable Alarms

See also: EA – Enquire Alarms
RA – Request Alarms

Command Code BR – Boolean/Algebraic Register Read

The BR command requests Boolean/algebraic variable data generated from user-defined equations downloaded to microFlow.net Gas.

Command:

"BR_X_YYY" Reads the Boolean / Algebraic Variable.

Where: X = F – Algebraic Floating Point
B – Boolean Variable
T – Timer Variable
S – String Variable

YYY = Variable number; 1 – 50 for Float and Boolean types;
1 – 8 for timers and strings.

Responses:

"OK" Good Response.
Where: X = F = Floating Point
T = Timer
B = Boolean
S = String

YYY = Variable Index (001 – 050 for F and B, 001-008 for T and S)
D...D = Requested Data; 0 to 1 for Boolean requests, numeric data for float and timer requests and Text (up to 32 chars) for string requests

or...

"NOXX"

See also: BW – Boolean/Algebraic Register Write

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code BW – Boolean/Algebraic Register Write

The BW command writes data to Boolean/algebraic variables used by user-defined equations downloaded to microFlow.net Gas.

Command:

"BW_X_YYY D...D"

Where: X = F – Algebraic Floating Point
B – Boolean Variable
T – Timer Variable
S – String Variable

YYY = Variable index (001 - 050 for Boolean and Float Types, 001 – 008 for Timer and String)
D…D = Data to write; 0 to 1 for Boolean requests, Numeric data for Float and Timer requests and up to 32 characters of text for String types

Responses:

"BW X YYY D...D" **Good Response.**

Where: X = F = Floating Point
T = Timer
B = Boolean
S = String

YYY = Variable Index (001 – 050 for F and B, 001-008 for T and S)
D...D = Requested Data; 0 to 1 for Boolean requests, numeric data for float and timer requests and Text (up to 32 chars) for string requests

or...

"NOXX"

See also: BR – Boolean/Algebraic Register Read

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code DY – Dynamic Displays

The DY command requests a dynamic display value from microFlow.net Gas. Information available includes current and load average batch data.

Command:

"DY_ddxx"

Where: dd = Dynamic Display Type
SY = System
CB = Current Batch

xx = Dynamic Display Index
System (00-17)
Batch Data (00-49)

Responses:

Dynamic Display Data

or...

"NOXX"

Dynamic Display Values – System Dynamic Displays

Index	Description	Format
00	Current meter factor	Mfac X.XXXXX
01	Current temperature	Temp XXX.X C
02	Current pressure	Pres XXX.X bar
03	Current line density	Obs Dens XXXX.X kg/m3
04	Current reference density	Ref Dens XXXX.X kg/m3
05	Current relative density	Rel Dens X.XXXX
06	Current line volume (IV) flow rate (fwd)	LineFlw XXXX.X m3/h
07	Current line volume (IV) flow rate (rev)	LineFlwR XXXX.X m3/h
08	Current ref. volume (GSV) flow rate (fwd)	RefVolFlw XXXX.X m3/h
09	Current ref. volume (GSV) flow rate (rev)	RefVolFlw XXXX.X m3/h
10	Current energy flow rate at reference (fwd)	EnergyFlw XXXX.X MJ/h
11	Current energy flow rate at reference (rev)	EnergyFlw XXXX.X MJ/h
12	Current energy/volume (heat value)	HV XXXX.X MJ/m3
13	Current Wobbe index (if using ISO 6976)	WobbeIndx XXXX MJ/m3
14	Current compressibility factor – reference	Compres Factor X.XXXX
15	Current compressibility factor – live	Compres Factor X.XXXX
16	Current compressibility ratio	Compres Ratio XXX.XX
17	Power Fail Date/Time	Last PwrFail 12/31/09 22:00:00

Dynamic Display Values – Current Batch Dynamic Displays

Index	Description	Format
00	Current batch #	Batch # 123456789
01	Current batch Start Time	Start Time 12/31/09 22:00:00
02	Indicated volume (IV) (forward)	IV XXXXXXX.XX m3
03	Indicated volume (IV) (reverse)	IV XXXXXXX.XX m3
04	Gross volume (GV) (forward)	GV XXXXXXX.XX m3
05	Gross volume (GV) (reverse)	GV XXXXXXX.XX m3
06	Gross@std temp/press (GSV) (forward)	GSV XXXXXX.XX m3
07	Gross@std temp/press (GSV) (reverse)	GSV XXXXXX.XX m3
08	Mass (forward)	Mass XXXX.X kg
09	Mass (reverse)	Mass XXXX.X kg
10	Energy (forward)	Energy XXXXX.X MJ
11	Energy (reverse)	Energy XXXXX.X MJ
12	Average indicated volume (IV) flow rate (forward)	LineFlow XXXX.X m3/h
13	Average indicated volume (IV) flow rate (reverse)	LineFlow XXXX.X m3/h
14	Average reference volume (GSV) flow rate (forward)	RefVolFlw XXXX.X m3/h
15	Average reference volume (GSV) flow rate (reverse)	RefVolFlw XXXX.X m3/h
16	Average energy flow rate@base conditions(forward)	EnergyFlw XXXX.X MJ/h
17	Average energy flow rate@base conditions(reverse)	EnergyFlw XXXX.X MJ/h
18	Average meter factor (if pulse input configured)	MtrFactor X.XXXXX
19	Average temperature	Temp XXX.X C
20	Average pressure	Pres XXX.X bar
21	Average line density	Obs Dens XXXX.X kg/m3
22	Average reference density	Ref Dens XXXX.X kg/m3
23	Average relative density	Rel Dens X.XXXX
24	Average energy per unit of volume (heat value)	HV XXXX.X MJ/m3
25	Average wobbe index (if using ISO 6976)	WobbeIndx XXXX MJ/m3
26	Avg. compressibility factor - ref	Compres Factor X.XXXX
27	Average compressibility factor – live	Compres Factor X.XXXX
28	Average compressibility ratio	Compres Ratio XXX.XX
29	Average methane %	Methane XX.XXXX%
30	Average nitrogen %	Nitrogen XX.XXXX%
31	Average carbon dioxide %	CO2 XX.XXXX%
32	Average ethane %	Ethane XX.XXXX%
33	Average propane %	Propane XX.XXXX%
34	Average water %	Water XX.XXXX%
35	Average hydrogen sulfide %	H2S XX.XXXX%
36	Average hydrogen %	Hydrogen XX.XXXX%
37	Average carbon monoxide %	CO XX.XXXX%
38	Average oxygen %	Oxygen XX.XXXX%
39	Average i-Butane %	i-Butane XX.XXXX%
40	Average n-Butane %	n-Butane XX.XXXX%
41	Average i-Pentane %	i-Pentane XX.XXXX%

Index	Description	Format
42	Average n-pentane %	n-Pentane XX.XXXX%
43	Average n-hexane %	n-Hexane XX.XXXX%
44	Average n-heptane %	n-Heptane XX.XXXX%
45	Average n-octane %	n-Octane XX.XXXX%
46	Average n-nonane %	n-Nonane XX.XXXX%
47	Average n-decane %	n-Decane XX.XXXX%
48	Average helium %	Helium XX.XXXX%
49	Average argon %	Argon XX.XXXX%

Remarks: No response exceeds 31 characters.

Constraints: NO06 will be returned if the requested batch has not been delivered (Bz qualifier). NO05 will be returned if there is no batch in progress and no batch has ever been done (TR qualifier). NO30 will be returned if a product of recipe is requested which is no currently allocated to the microFlow.net Gas to which the command was directed. NO31 will be returned if the command format does not match the current configuration.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code EA – Enquire Alarms

The EA command retrieves the alarm status from microFlow.net Gas. Data is returned in a bit-mapped format.

Command:

"EA"

Responses:

"A1A2A3...A10" **Good Response.** Ten characters for injectors.

or...

"NOXX" Alarm status cannot be reported.

See also: AR – Alarm Reset
RA – Request Alarms

Response to Enquire Alarms

	Hex Value			
	0x08	**0x04**	**0x02**	**0x01**
A1	DA: RAM Corrupt	DA: Flash Error	DA: RAM Bad	DA: ROM Bad
A2	DA: Passcodes Reset	DA: Prog Error	DA: Watchdog	DA: Flash Backup Ba
A3	U3: User Alarm 3	U2: User Alarm 2	U1: User Alarm 1	PA: Powerfail Alarm
A4	PS: Pulse Security	CM: Communications	U5: User Alarm 5	U4: User Alarm 4
A5	HF: High Flow	PR: Pressure Trans	DR: Density Trans	TP: Temp Probe
A6	LF: Low Flow	HP: High Pressure	HD: High Density	HT: High Temperatur
A7	MC: Mass Meter Comm Fail	LP: Low Pressure	LD: Low Density	LT: Low Temperature
A8	SP: Shared Printer	PP: PTB Printer	MT: Mass Meter Tube	MO: Mass Meter O drive
A9		UM: Ultrasonic Meter Alarm	UC: Ultrasonic Meter Comm Fail	SA: Sampler Error

Remarks: Allow for additional characters to be added to the end when alarms are added in the future.

Constraints: NO30 will be returned if the additive specified is not currently configured to the microFlow.net Gas which the request was sent. NO31 will be returned if the command format does not match the current configuration.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code EQ – Enquire Status

The EQ command retrieves the operational status of microFlow.net Gas. Data is returned in a bit-mapped format.

Command:

"EQ"

Responses:

"A1A2A3A4A5" **Good response:** 5 characters. For descriptions of each of the characters, see the following pages.

Where: each "A" is a "quasi hex" value; "0 1 2 3 4 5 6 7 8 9 : ; < > ?".

The characters are encoded as follows:

	Quasi Hex Value			
	0x08	**0x04**	**0x02**	**0x01**
A1	Program mode	Reserved	Flowing	Reserved
A2	Reserved	Reserved	Batch reset occurred	Reserved
A3	Printing in Progress	Reserved	Reserved	Alarm
A4	Prog value changed	Reserved	Reserved	Power fail occurred
A5	Checking entries	Input #1	Input #2	Input #3

See also: RS – Request Status
RE – Reset Status Flags

Remarks: Allow for additional characters to be added on the end for future status indicators. For bay configurations – SA, SF, TD, and TP – refer to the bay. Other flags continues to be specific to the load arm.

Constraints: None

Special Case: The microFlow.net Gas is considered released whenever the valve is opened and has not been commanded to close.

Comm. Modes: No Control, Host Control, Poll and Program

Command Code ER – Event Recall

The ER command requests historical data from microFlow.net Gas using the sequence number of the event.

Command:

"ER_S...S"

Where: S...S = Event Sequence Number

Responses:

"ES_SSSSSSSSSS_DDDDDDDD_HHNN_EEEEE_A...A" **Good Response**

Where: SSSSSSSSSS = Event Sequence Number
DDDDDDDD = Standard Time "MMDDYYY" or Military Time "DDMMYYYY"
HHHH = Time
X = Time Type (A for AM, P for PM, M for military)
EEEEE = Event Type Number
A...A = Event Data

or...

"NOXX"

See also: ES – Last Event Sequence Number

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code ES – Last Event Sequence Number

The ER command requests the sequence number of the most recent event stored by the microFlow.net Gas.

Command:

"ES"

Responses:

"ES_SSSSSSSSSS" Good Response

Where: SSSSSSSSSS = Event Sequence Number

or...

"NOXX"

See also: ER – Event Recall

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code FL – Request Meter Pulse Count

The FL command retrieves raw pulse counts from microFlow.net Gas. The count is reset to zero at the start of each batch.

Command:

"FL" Read flow count for the arm (straight, sequential, ratio)

Responses:

"FL_VVVVVVVVVV" Good Response.

Where: VVVVVVVVVV = Meter Pulse Count

or...

"NOXX"

Remarks: None.

Constraints: VVVVVVVVVV is unfactored raw pulse count. This value is reset to zero at start and end of each batch.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code GD – Get Date and Time

The GD command requests the current date and time programmed at microFlow.net Gas.

Command:

"GD"

Responses:

"GD_DDDDDDDD_HHNN_X" **Good Response.**

Where	DDDDDDDD	= MMDDYYYY (Standard Time)
		= DDMMYYYY (Military Time)
	HH	= Hours
	NN	= Minutes
	X	= A (Standard Time – A.M.)
		= P (Standard Time – P.M.)
		= M (Military Time)

or...

"NOXX"

See also: SD – Set Date and Time

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code GP – Get Firmware CRC

The GP command retrieves the computed CRC for the firmware currently installed in microFlow.net Gas.

Command:

"GP"

Responses:

"AV_X_YY_VVVVV.VVV" **Good Response**

Where: SSSSSSSS = Eight-Character hexadecimal CRC-32

or...

"NOXX"

Remarks: CRC signatures may be used to determine firmware revision number. Contact the factory with inquiries.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code LD – Batch Average Density

The LD command requests batch average density from microFlow.net Gas.

Command:

Current Batch
"LD" (for the current batch)
"LD_R" (for the current batch – deprecated)
"LD_01" (for the current batch – deprecated)
"LD_NNN" (for a completed batch)
"LD_01_NNN" (for a completed batch – deprecated)

Responses:

Current Batch	Good Response
"LD_SVVVV.V"	For command LD
"LD_01_RR_SVVVV.V"	For commands LD_R, LD_01
"LD_SVVVV.V_NNN"	For command LD_NNN
"LD_01_RR_SVVVV.V_NNN"	For command LD_01_NNN

Where: VVVV.V = Batch average density for the requested batch.
NNN = Number of batches back into Local Storage to retrieve data.
RR = Reserved Field
R = Current Batch
S = Sign (+/-)

or...

"NOXX"

See also: LT – Batch Average Temperature
LP – Batch Average Pressure
RD – Request Analog Input Value

Remarks: Response field padded with leading spaces. If value is negative, minus sign will immediately precede most significant digit.

Constraints: Density units area as programmed in the microFlow.net Gas.NO30 will be returned if the product specified is not currently configured to the microFlow.net Gas to which the command was directed. NO31 will be returned if product load averages are requested for a microFlow.net Gas currently configured for straight product delivery.

Special Case: None

Comm. Modes: No Control, Host Control, Poll and Program

Command Code LO – Request Logout of Program Mode

The LO command removes microFlow.net Gas from the program mode and causes all changes made via PC command to be saved.

Command:

"LO"

Responses:

OK

or...

"NOXX"

See also: PC – Program Code Change

Remarks: Ten seconds after issuing a PC command, the microFlow.net Gas begins the logout process. The "LO" command starts it immediately. All changes made by the PC command are not available (made active) until the logout process is complete.

Constraints: Logout may only be forced if the comm port is the one logged in (i.e., Port #1 cannot logout Port #2).

Special Case: None.

Comm. Modes: Host Control, Poll and Program.

Command Code LP – Batch Average Pressure

This command requests the batch average pressure from the microFlow.net Gas.

Command:

Current Batch

"LP" (for the current batch)
"LP_R" (for the current batch – deprecated)
"LP_01" (for the current batch – deprecated)
"LP_NNN" (for a completed batch)
"LP_01_NNN" (for a completed batch – deprecated)

Responses:

Current Batch	**Good Response.**
"LP_SVVVV.V"	For command LP
"LP_01_RR_SVVVV.V"	For commands LP_R, LP_01
"LP_SVVVV.V_NNN"	For command LP_NNN
"LP_01_RR_SVVVV.V_NNN"	For command LP_01_NNN

Where: VVVV.V = Batch average pressure for the requested batch
NNN = Number of batches back
RR = Reserved Field
R = Current Batch
S = Sign (+/-)

or...

"NOXX"

See also: LT – Batch Average Temperature
LD – Batch Average Density
RD – Request Analog Input Value

Remarks: None

Constraints: Pressure units are as programmed for the microFlow.net Gas. NO30 will be returned if the product specified is not currently configured to the microFlow.net Gas to which the command was directed. NO31 will be returned if product load averages are requested for a microFlow.net Gas currently configured for straight product delivery.

Special Case: None

Comm. Modes: No Control, Host Control, Poll and Program

Command Code LT – Batch Average Temperature

This command requests the batch average temperature from the microFlow.net Gas.

Command:

Current Batch

"LT" (for the current batch)
"LT_R" (for the current batch – deprecated)
"LT_01" (for the current batch – deprecated)
"LT_NNN" (for a completed batch)
"LT_01_NNN" (for a completed batch – deprecated)

Responses:

Current Batch	**Good Response.**
"LT_SVVVV.V"	For command LT
"LT_01_RR_SVVVV.V"	For commands LT_R, LP_01
"LT_SVVVV.V_NNN"	For command LT_NNN
"LT_01_RR_SVVVV.V_NNN"	For command LT_01_NNN

Where: R = Current Batch
S = Sign (+/-)
RR = Reserved field – may be used in future revisions (always 01 now)
VVVV.V = Batch average temperature for the requested batch
NNN = Number of batches back

or...

"NOXX"

See also: LD – Batch Average Density
LP – Batch Average Pressure
RD – Request Analog Input Value

Remarks: None

Constraints: Temperature units are as programmed for the microFlow.net Gas. NO30 will be returned if the product specified is not currently configured to the microFlow.net Gas to which the command was directed. NO31 will be returned if product load averages are requested for a microFlow.net Gas currently configured for straight product delivery.

Special Case: None

Comm. Modes: No Control, Host Control, Poll and Program

Command Code MC – Mass Meter Communications

The MC command sends the m…m mass meter command out the port defined as mass meter communications port. Once the response to the command is received by the microFlow.net Gas it will be available via the MR command.

Command:

"MC_m...m"

Where m...m = Mass Meter command text as defined in MN0M008 for the S-Mass, or MN0M12 for the Apollo.

Responses:

"OK" Good Response.

or...

"NOXX" The command was not sent to the Mass Meter.

Remarks: See "MR" for retrieval of the response from the mass meter.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code MR – Mass Meter Response

This command returns the last response received by the microFlow.net Gas from the mass meter.

Command:

"MR"

Responses:

"MR_r...r" **Good Response.**

Where
r...r = Response to the last command sent to the master meter via the MC command.

or...

"NOXX" No response is available from the mass meter.

When the microFlow.net Gas receives an MC command, the m…m portion of the command will be sent out the port defined as the mass meter communication port and an OK response will be sent to the host. The microFlow.net Gas will be monitoring the mass meter communications port for a response from the mass meter. The host will use the "MR" command to retrieve any response from the mass meter. If the host sends an "MR" command before any data has been received from the mass meter, the microFlow.net Gas will respond with a "NO06".

Remarks: See "MC" for a description of how to send a command to the mass meter.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code OR – Output Relay

The OR command requests that the state of one or more of the general purpose outputs be changed.

Command:

"OR_XX_Y"

Where XX = the output number (01-06)
Y = desired state (1 = on, 0 = off)

Responses:

"OK" **Good Response.** The command was accepted and the desired state was output to the selected contact.

or...

"NOXX" The command was rejected. The microFlow.net Gas did not request a state change at the selected output.

Remarks: "NO03" will be returned if XX or Y is out of range. "NO06" will be returned if the output is not assigned as a general purpose output.

Constraints: This command will not be allowed if the corresponding relay is not configured as a general purpose relay.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code PC – Change Program Code Change

The PC command facilitates modification of program mode parameters by specifying the major directory, program code number, and new value.

Command:

"PC_DD_XXX_V...V"

Where DD = Major Directory
CF = Configuration
SY = System
01-12 = Recipe Number
XXX = Parameter Number
V...V = New Value, content depends on parameter

Responses:

"OK" Good Response.
Where DD = Program mode major directory
XXX = Parameter Number
V...V = Requested new value
A..A = Programmed value

or...

"NOXX"

See also: LO – Log Out of Program Mode
PV – Program Code Value

Remarks: The number of digits or alpha characters entered for the new program code must be EXACTLY equal to the number of digits or alpha characters required for that particular program code, except for codes requiring text strings.

Due to the varying lengths of the programmable display messages, the number of digits or alpha characters entered for the new program code can number up to a maximum of 30. However, the number of digits or alpha characters stored will depend on the maximum length of that particular message being changed.

Constraints: Refer to the Reference section in the Operations Manual for a complete list of parameters in each directory.

Special Case: None.

Comm. Modes: Host Control, Poll and Program.

Command Code PF – Request Power Fail Time

The PF command retrieves the date and time of the last power fail sustained by microFlow.net Gas.

Command:

"PF"

Responses:

"PF_DDDDDDDD_HHNN_X" Good Response.

Where	DDDDDDDD	= Power-Fail Date
		= (MMDDYYYY for Standard Time)
		= (DDMMYYYY for Military Time)
	HH	= Power-Fail Time, Hours
	NN	= Power-Fail Time, Minutes
	X	= A (Standard Time – A.M.)
		= P (Standard Time – P.M.)
		= M (Military Time)

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code PP – Print Report to Printer

The PP command initiates a reprint of the requested batch report at the printer.

Command:

"PP"	for the most recently completed batch
"PP NNN"	for NNN batches back in local storage

Responses:

Good Response:

"OK"

or...

"NOXX"

See Also: PT – Print Batch Report to Host

Remarks: None.

Constraints: A printer port must be configured.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code PR – Program Change Event Recall

The PR command requests NIST related historical data tracking program mode changes.

Command:

"PR_S...S"

Where S...S is the sequence number.

Responses:

Good Response:
"PR_SSSSSSSSSS_DDDDDD_HHNN_X_EEEEE_A...A"
Where:

SSSSSSSSSS	= Sequence number
DDDDDDDD	= Standard Time (MMDDYYYY) or Military Time (DDMMYYYY)
HH	= Hours
NN	= Minutes
X	= Program change time type (A for AM, P for PM, M for military)
EEEEE	= Event type number
A...A	= Event data

or...

"NOXX"

See also: PS – Last Program Change Sequence Number

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: Host Control, No Control, Poll and Program.

Command Code PS – Last Program Code Change Recall

The PS command requests the sequence number of the most recent program mode change stored by microFlow.net Gas.

Command:

"PS"

Responses:

"PS_SSSSSSSSSS" Good Response.

Where:
SSSSSSSSSS = Sequence number

or...

"NOXX" Sequence number not retrieved.

See also: PR – Program Change Event Recall

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: Host Control, No Control, Poll and Program.

Command Code PT – Print Batch to Host

The PT command allows a batch report to be generated directly to the host over the existing communications line. The microFlow.net Gas first responds with an OK response (framed normally according to the current host protocol) followed by the report text. No additional framing characters appear before, during or after the report text other than those returned with the normal OK response.

Example response in Minicomputer mode:
<STX> O K <ETX> <LRC> <PAD> [report text ……]

Command:

"PT"	for the most recently completed batch
"PT NNN"	for NNN batches back in local storage

Responses:

"OK" (followed by the report text) **Good Response.**

or...

"NOXX"

See Also: PP – Print Report to Printer

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code PV – Program Code Value

The PV command requests the currently configured value for program mode parameters.

Command:

"PV_DD_XXX"

Where DD = Major Directory
CF = Configuration
SY = System
01-12 = Recipe Number

XXX = Program Code Number

Responses:

"PV_DD_XXX_A...A" Good Response.

Where DD = Directory
CF = Configuration
SY = System
01-12 = Recipe Number
XXX = Parameter Number
A...A = Current value, content depends on parameter
or...

"NOXX" Program value not read.

See also: PC – Program Code Change

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Note: *The "+" argument appended to the PC command string affects the number of significant digits returned for floating point numbers. For the "+" version of the command, additional decimal digits may be included in the response beyond the specified format for the program code if they are non-zero (up to a maximum of six total digits to the right of the decimal point).*

Examples

01PV 01 005	PV 01 005 000.0 1st Percentage
01PC 01 005 23.36	PC 01 005 023.4 1st Percentage
01PV 01 005	PV 01 005 023.4 1st Percentage
01PV 01 005+	PV 01 005 023.36 1st Percentage
01PC 01 005+23.64	PC 01 005 023.64 1st Percentage
01PV 01 005	PV 01 005 023.6 1st Percentage
01PV 01 005+	PV 01 005 023.64 1st Percentage

Command Code RA – Request Alarms

The RA command requests currently active alarms from microFlow.net. Data is returned as two-character mnemonics for each alarm reported. A maximum of five alarms will be reported regardless of the number of alarms actually active on microFlow.net Gas.

Command:

"RA"

Responses:

String of up to five 2-character alarm identifiers separated by spaces

See also: AR – Alarm Reset
EA – Enquire Alarms

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code RD – Request Current Transducer Value

The RD command requests the current engineering value of one of the analog inputs configured and installed at microFlow.net Gas, based on input function.

Command:

"RD_X" Request specific transducer value.

Where Z = T (current temperature)
= P (current pressure)
= D (current density)

Responses:

"RD_X_VVVV.V" **Good Response.**
"RD_X_SVVVV.V" **Good Response.**

Where X = Number of the analog input
0 = RTD
1 = 4-20mA
S = Sign (+ or -)
VVVV.V = Current value of the analog input

or...

"NOXX"

Remarks: Length of Response depends on the number of meters programmed for the arm.

Constraints: NO30 will be returned if the requested product is not allocated to the microFlow.net Gas to which the command was directed. NO31 will be returned if the command format does not match the current configuration.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code RE – Reset Status Flags

The RE command resets or acknowledges pending status conditions of the microFlow.net Gas.

Command:

"RE_XX"

Where XX = Status flag to be reset
PF = power fail
BD = Batch reset occurred
PC = program code value has changed

Responses:

"OK" **Good Response.**

or...

"NOXX" The status condition has not been reset.

See also: PC – Program Code Change
PF – Request Power Fail Time

Remarks: None.

Constraints: When using a card reader, RE CD will cancel card validation and prevent additional batches without another card-in (if the microFlow.net Gas is configured for card-in required options).

Special Case: "TD" and "BD" statuses are also reset on authorize commands.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code RQ – Request Current Flow Rate

This command retrieves the current flow rate from the microFlow.net Gas.

Command:

"RQ"

Responses:

"RQ_XXXXX" **Good Response.**

where:	D	=	'F' for forward direction
		=	'R' for reverse direction
	XXXX	=	Flow rate

or ...

"NOXX" Flow rate was not returned.

Remarks: None.

Constraints: NO31 will be returned if the command format is inconsistent with the currently configured mode of operations.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code RS – Request Status

The RS command requests the operational status of microFlow.net Gas. Data is returned as two-character mnemonics for each status reported. A maximum of twenty status codes will be reported.

Command:

"RS"

Responses:

"RS_XX_XX_XX_XX ...XX" **Good Response.** String of up to 20 2-character status codes.

Where each XX is one of the following:

AL	alarm active
CE	checking entries
FL	flowing
BD	Batch reset occurred (clearable by host)
I1	input 1 on
I2	input 2 on
I3	input 3 on
PC	program parameter changed (clearable by host)
PD	permissive delay active
PF	power fail occurred
PP	printing in progress
PW	in program mode
TP	Batch in progress
RL	Reserved

See also: EQ – Enquire Status
RE – Reset Status Flag

Remarks: The microFlow.net Gas is considered released whenever the valve is open and has not been commanded to close. Some alarm conditions cannot be reset through the Communication channel. (See Alarm Reset command).

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code RT – Request Batch Volume

The RT command requests batch data from microFlow.net Gas.

Command:

"RT_X"	(total volume of the current batch – forward direction of flow).
"RT_X_NNN"	(total volume of a completed batch – forward direction of flow)
"RT_X_D"	(total volume of the current batch – specific flow direction)
"RT_X_D_NNN"	(total volume of a completed batch – specific flow direction)

Responses:

Good Response:

"RT_X_VVVVVVVVVV"	for RT X form; current batch volume
"RT_X_D_VVVVVVVVVV"	for RT X D form; current batch volume
"RT_X_VVVVVVVVVV_NNN"	for RT X NNN form; batch volume, historical
"RT_X_D_VVVVVVVVVV_NNN"	for RT X D NNN form; batch volume, historical

Where:

X = Desired volume type
- R = Raw (IV or indicated)
- G = GRS (Gross)
- P = GSV (Gross @ Std Temp & Press)
- M = Mass
- N = Energy (Energy content BTU or MJ)

D = Direction of flow
- F = Forward
- R = Reverse

VVVVVVVVVV = Batch volume

NNN = Number of batches back

or...

"NOXX" No Batch data was returned.

Remarks: For Total Volume Requests; (RT_X and RT_X_NNN) "MR" as the recipe number on the response indicates a multiple recipe batch. For bay configurations, the returned values represent bay batch totals.

Constraints: Batch Volume Units are assumed to be as programmed into the microFlow.net Gas. NO03 will be returned for a recipe request if the recipe requested was not delivered in the batch. NO30 will be returned if the product or recipe specified is not currently configured to the microFlow.net Gas to which the command was directed. NO31 will be returned if product batch totals are requested for a microFlow.net Gas currently configured for straight product delivery.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code SB – Reset Batch

The SB command is used to reset the batch, marking the current batch as complete and storing the data in non-volatile memory, then incrementing the current batch number, clearing the totalizers and resetting the average values for the new batch.

Command:

"SB"

Responses:

"OK" **Good Response.**

or...

"NOXX"

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: Host Control.

Command Code SD – Set Date and Time

The SD command sets the date and time at microFlow.net Gas.

Command:

"SD_DDDDDDDD_HHNN_X"

Where	DDDDDDDD	= Date
		= DDMMYYYY (Military Time)
		= MMDDYYYY (Standard Time)
	HH	= Hours
	NN	= Minutes
	X	= A (Standard Time – A.M.)
		= P (Standard Time – P.M.)
		= M (Military Time)

Responses:

"OK" **Good Response.** Time and date value accepted and seconds reset to zero.

or...

"NOXX" The time and date were not accepted.

See also: GD – Get Date and Time

Remarks: None.

Constraints: Time value must be within range programmed in microFlow.net Gas – 0000 to 2359 for Military, 0000 to 1259 for Standard; month must be within the range of 1 to 12; day must be valid for the month chosen.

Special Case: Leading spaces may be used in place of leading zeros for month, day, year, hours, and minutes. However, this is not recommended.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code TN – Request Batch Number

The TN command requests the batch number and batch stop date and time for the most recent or historical batch run.

Command:

"TN"
"TI_NNN"

Responses:

Good Response.
"TN_IIII_DDDDDDDD_HHNN_X" (Start time of the current batch)
"TN_IIII_DDDDDDDD_HHNN_X_NNN" (End time of requested completed batch)

Where:

IIII	= Batch Number
DDDDDDDD	= Date
	= (MMDDYYYY for Standard Time)
	= (DDMMYYYY for Military Time)
HH	= Hours
NN	= Minutes
X	= A (Standard Time – A.M.)
	= P (Standard Time – P.M.)
	= M (Military Time)
NNN	= Number of batches back (Valid range 001 …)

or...

"NOXX"

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code TR – Batch Summary Recall

The TR command requests historical batch summary data from microFlow.net Gas using the batch number.

Command:

"TR_S...S"

Responses:

"TR_SSSSSSSSSS" [batch data] **Good Response.**

Where:

S...S = is the batch number and [batch data] is a comma-delimited text record with the following fields:

- Batch number
- Batch Start Date/Time
- Batch End Date/Time
- 5 volume totals (IV, GV, GSV, Mass, Energy – forward direction),
- 5 non-resettable totalizer Values (IV, GV, GST, GSV, Mass – forward)
- 5 volume totals (IV, GV, GSV, Mass, Energy – reverse direction),
- 5 non-resettable totalizer Values (IV, GV, GST, GSV, Mass – reverse)
- 7 batch average values (meter factor, temperature, ρ_{line}, ρ_{ref}, ρ_{rel}, pressure, energy content)
- 5 numeric prompt responses
- 5 alphanumeric prompt responses
- Number of alarms occurring during the batch
- Alarm codes for alarms occurring during the batch (Text field)

or...

"NOXX" If the batch record does not exist or the command is improperly formatted.

Note: *The comma delimiter will still be present, even if a field is blank.*

See also: TS – Last Event Sequence
TU – Batch Log Archived User Data

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code TS – Batch Log Latest Batch Number

The TS command requests the batch number of the most recent (current) batch.

Command:

"TS"

Responses:

"TS_SSSSSSSSSS" Good Response.

Where: SSSSSSSSSS = Current batch number.

or...

"NOXX"

See also: TR – Batch Summary Recall
TU – Batch Log Archived User Data

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code TU – Batch Log Archived User Data

The TU command requests historical batch archived user data from microFlow.net Gas using the number of the batch.

Command:

"TU_S...S"

Responses:

"TU_SSSSSSSSSS" [batch user data] **Good Response.**

Where:

SSSSSSSSSS	= Batch Number
And	[batch user data] is a comma-delimited text record with the following fields:
	5 Integer Values (0-255) representing the values in USERBOOL46-USERBOOL50 at the end of the batch;
	5 User Floating Point Values corresponding to the values in USERFLOAT46-USERFLOAT50 at the end of the batch,
And	Optionally depending on Program Code System 739, 8 User text fields

or...

"NOXX"

Note: *Some fields may be empty, i.e. if no user text was entered, the user text fields will not contain any data. The comma delimiter will still be present, even if a field is blank.*

See also: TS – Last Batch
TR – Batch Log Summary Recall

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: Host Control, Poll and Program.

Command Code VT – Non-resettable Total

The VT command requests a non-resettable total from microFlow.net Gas. Recipe totals in five volume types and additive totals are available.

Command:

"VT_X"	Non-resettable totals (forward direction)
"VT_X_D"	Non-resettable totals.(reverse direction)

Responses:

"VT_X_D_VVVVVVVVV" **Good Response.**

Where:

X = Desired volume type
- G = Gross (GV)
- N = Energy
- P = GSV
- M = Mass

VVVVVVVVV = Non-resettable total

D = Direction of flow
- F = Forward
- R = Reverse

Remarks: Recipes and Additives must be allocated.

Constraints: NO30 will be returned if the additive component, or recipe requested is not currently configured to the microFlow.net Gas to which the request was directed.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code XC – Change Parameter Security Level

The XC command instructs microFlow.net Gas to modify the security level of a program mode parameter.

Command:

"XC_DD_YYY_Z"

Responses:

"XC_DD_YYY_Z_A..A" **Good Response.**

Where DD = Program mode major directory
CF = Configuration
SY = System
01-12 = Recipe Number

YYY = Parameter Number
Z = New Security level to set (1-3)
A...A = Programmed Value

or...

"NOXX"

See also: XV – Read Parameter Security Level

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Command Code XV – Read Parameter Security Level

This command requests the current security level for a program mode parameter.

Command:

"XV_DD_YYY"

Responses:

"XV_XX_YYY_Z_A..A" **Good Response.**

Where DD = Program mode major directory
CF = Configuration
SY = System
01-12 = Recipe Number

YYY = Parameter Number
Z = New Security level to set (1-3)
A...A = Programmed Value

or...

"NOXX"

See also: XC – Change Parameter Security Level

Remarks: None.

Constraints: None.

Special Case: None.

Comm. Modes: No Control, Host Control, Poll and Program.

Appendix I – Reference for "NOXX" Responses

XX	Description
00	Invalid Command
01	In Program Mode
02	Released
03	Value Out of Range
04	Flow Active
05	No Batch Ever Done
06	Operation Not Allowed
07	Wrong Control Mode
08	Batch In Progress
09	Alarm Condition
10	Storage Full
11	Operation Out Of Sequence
12	Power Fail During Batch
13	Comm Authorized
14	Program Code Not Used
15	Display/Keypad In Use
16	Ticket Not In Printer
17	No Keypad Data Pending
18	No Batch In Progress
19	Option Not Installed
20	Start After Stop Delay
21	Permissive Delay Active
22	Print Request Pending
23	No Meter Enabled
24	Must Be In Program Mode
25	Ticket Alarm During Batch
26	Volume Type Not Selected
27	Exactly One Recipe Must Be Enabled
28	Batch Limit Reached
29	Checking Entries
30	Product/Recipe/Additive Not Assigned
31	Invalid Argument For Configuration
32	No Key Ever Pressed
33	Reserved
34	Reserved
35	Reserved
36	Card-In Required
37	Data Not Available
38	Reserved
41	No Pending Reports to Print
90	Must Use Mini Protocol
91	Buffer Allocation Failure
92	Keypad Locked
93	Data Recall Failure
94	Not In Program Mode
95	Security Access Not Available
99	Internal Error

Appendix II – Alphanumeric Character Set Used By the microFlow.net Gas

The following characters are translated by the microFlow.net Gas to display special characters not found on a typical keyboard: the tilde (~) will display as a degree sign at the microFlow.net Gas; degree signs sent by the microFlow.net Gas in a response will appear as a tilde (~) on your computer. The vertical bar (|) translates to a script lowercase "l", used to denote liters of volume.

Lowercase letters may not be used to issue any of the two-digit command codes (SB, GD, EA, etc.); a NO00, Command Non-existent, will be returned as the response.

Some special characters (for example, [,], &, +, -, and .) are used in prompting or other data entry; all other special characters and lowercase letters are typically used in prompts and textual descriptions entered at the microFlow.net Gas, such as the product name, etc. The comma (,) may not be used within any prompt (WA-WG, WX, WQ, WP.)

ASCII	DECIMAL	HEX
NUL	0	0
STX	2	2
ETX	3	3
LF	10	A
CR	13	D
SP	32	20
!	33	21
"	34	22
#	35	23
$	36	24
%	37	25
&	38	26
`	39	27
(	40	28
)	41	29
*	42	2A
+	43	2B
'	44	2C
-	45	2D
.	46	2E
/	47	2F
0	48	30
1	49	31
2	50	32
3	51	33
4	52	34
5	53	35
6	54	36
7	55	37
8	56	38
9	57	39
:	58	3A
;	59	3B
<	60	3C
=	61	3D
>	62	3E
?	63	3F

ASCII	DECIMAL	HEX
@	64	40
A	65	41
B	66	42
C	67	43
D	68	44
E	69	45
F	70	46
G	71	47
H	72	48
I	73	49
J	74	4A
K	75	4B
L	76	4C
M	77	4D
N	78	4E
O	79	4F
P	80	50
Q	81	51
R	82	52
S	83	53
T	84	54
U	85	55
V	86	56
W	87	57
X	88	58
Y	89	59
Z	90	5A
[	91	5B
\	92	5C
]	93	5D
^	94	5E
-	95	5F
`	96	60
a	97	61
b	98	62
c	99	63
d	100	64
e	101	65
f	102	66
g	103	67
h	104	68
i	105	69
j	106	6A
k	107	6B
l	108	6C
m	109	6D
n	110	6E
o	111	6F

ASCII	DECIMAL	HEX
p	112	70
q	113	71
r	114	72
s	115	73
t	116	74
u	117	75
v	118	76
w	119	77
x	120	78
y	121	79
z	122	7A
{	123	7B
|	124	7C
}	125	7D
~	126	7E
DEL	127	7F

ASCII Codes

Appendix III – Using the Bit-Map Tables

Many command codes in this manual use bit-mapping to encode information concisely and in as short a form as is possible. Up to four discrete bits of information may be represented by a single ASCII character, both as commands to and responses from the microFlow.net Gas. Most command codes that use bit-mapping consist of two or more such ASCII characters. This appendix describes how to encode or decode a single ASCII character; the process can be repeated for each additional character.

Each option listed across the top of the table carries a binary weighted value associated with it. From right to left, the values are 1, 2, 4, and 8. This is why the table headers may appear to be listed backwards. Special characters are used to represent hexadecimal values A through F, which equate to decimal values 10 through 15, when the bit values for selected options are added together. The “char” column, not the “hex” column, is used to encode and decode ASCII characters.

Encoding a Bit-Mapped Character

An X in the table indicates a selected option. First, determine which of the four column header options will be encoded. Find the row that contains Xs for the options selected. The character listed along the left axis is equal to the value of the options selected.

For example, consider the “AB” command. Suppose we want to enable recipes 1, 3, 6, 7, and 8. Recipes 1 and 3 can be represented in the first ASCII character. The row containing Xs for 1 and 3 only corresponds to the ASCII character “5.” Therefore, the first character of the AB command will be 5. Recipes 6, 7, and 8 can be represented in the second ASCII character. The character corresponding to these values is a “>,” so the second character of the AB command will be >. Because no recipes have been selected that can be encoded in the third, fourth, fifth, or sixth characters of the AB command, these characters will be 0’s.

The complete AB command to enable recipes 1, 3, 6, 7 and 8 is “AB 5>0000.”

Decoding a Bit-Mapped Character

An X in the table indicates an asserted value. Decoding a character is just the opposite of encoding a character. Find the returned ASCII character in the column along the left. For each X in that row, refer to the column header to determine what option or condition is asserted.

For example, consider the following response to the “EQ” command: “580027”

“5” represents microFlow.net Gas Authorized and microFlow.net Gas Released

“8” represents Batch in Progress

“0” represents no conditions met in character 3

“0” represents no conditions met in character 4

“2” represents Input #2 contact

“7” represents Input #5, Input #6, and Input #7

“0” represents no conditions met in character 7

“0” represents no conditions met in character 8.

Appendix IV – Interfacing with the microFlow.net Gas via Ethernet (TCP/IP)

Parameters Affecting TCP/IP Communications

Address: Note that the address is in the form of a TCP/IP address – 4 numbers, each from 0-255. Since each of the 4 numbers can be stored in 8 bits of data, they are often referred to by the term “octet”. The last octet in the IP address is the value used for the communications address for the RS232/RS485 ports.

Netmask: This program code allows the entry of the network mask. Internet standards specify that each IP address has two parts – one part is the network address, and the other part is the host machine’s address on the network. Due to the dynamic nature of the Internet, these “parts” are not always divided up in the same place. There are different “classes” of networks, and hence different “masks” defining which bits in the IP address are the network portion of the address. The remaining bits are the host address.

A very common network, the class “C” network, has a netmask of 255.255.255.0. This means that the first 3 octets (24 bits) define the network, and the last octet (8 bits) defines the specific machine on the network. Taking into account the reserved addresses of 0 and 255, this allows for 254 hosts on a class “C” network.

Gateway: This address specifies where the host should send IP packets when the IP address has a different network than the host. This address specifies the address of a switch or router that will pass packets to networks other than the local network out to the Internet. Note that application layer protocols such as FTP or HTTP connecting to the microFlow.net Gas from outside do not require any value to be programmed here; this entry is only used for initiating a connection from the microFlow.net Gas to a point outside the local network.

Using the Smith Meter protocol over TCP/IP

The microFlow.net Gas has a reserved port that supports Smith Meter Terminal communications. This protocol is currently fixed at port 7734. The microFlow.net Gas expects a single complete command to be contained in each packet received. The microFlow.net Gas will currently ignore fragmented commands or any additional commands after the first in a packet. Due to the relatively small size of the Smith command frame, this usually poses no problem for the communicating client. However, most Telnet-type programs will attempt to send data as soon as it is entered, so the resulting packets received by the microFlow.net Gas do not have complete commands and are ignored. The microMate has a built in tool – the Terminal Emulator – that sends an entire command in one packet. Custom software written to communicate with the microFlow.net Gas can duplicate this functionality easily by submitting a completely formed communication command along with any required arguments to the TCP transport layer all at once.

Appendix V – Windows Setup of SLIP Ports

Windows 2000

- From *Control Panel*, select: *Network and Dial-up Connections*
- Select: *Make New Connection* to start the *New Connection* wizard
- Select: *Connect to Another Computer* on the first page of the wizard
- Select: *Guest* on second page of the wizard
- Select the desired comm. port on the third page of the wizard
- Select: *For all Users*
- Name the connection appropriately (i.e. “microFlow SLIP connection”)
- If prompted to login, click *Properties* or return to *Network Connections* folder, find new connection, right click and select: *Properties*
- Under *General* tab verify the device port desired, click on *Configure*, set baud rate appropriately
- Under *Options* tab disable prompt for name and password, etc.
- Under *Networking* tab
  - Select *SLIP: UNIX Connection* in the *Type of Dial-up Server I am Calling* combo box
  - Clear all check boxes except for *Internet Protocol (TCP/IP)*
  - Click *Properties* for the Internet Protocol component
    - In the Properties dialog for the TCP/IP connection, select *Use the following IP Address*, and specify an address that is different but on the same subnet as the microFlow.net Gas (i.e. if your microFlow.net Gas is 192.168.0.1, make the address for the SLIP client 192.168.0.9 or similar.

Windows XP

- From *Control Panel*, select: *Network and Internet Connections*
- Select: *Create a New Connection* to start the *New Connection* wizard
- From the *Network Connection Type* page select: *Set up an advanced connection*
- From the Advanced Connection Options page select: Connect directly to another computer
- From the *Host or Guest?* page select *Guest*
- On the *Connection Name* page, name the connection appropriately (i.e. “microLoad SLIP connection”)
- From the *Select a Device* page select Communications Cable between two Computers (COM _) from the list
- From the *Connection Availability* page select *Anyone’s use*
- On the *Connect* page leave *Save this user name and password for the following users* unchecked
- From Connect page select: *Properties*
- Under *General* tab select *Communications cable between two computers* then, click on *Configure*, set baud rate appropriately
- Under *Options* tab uncheck *Dialing options*
- Under *Networking* tab
  - Select *SLIP: UNIX Connection* in the *Type of Dial-up Server I am Calling* combo box
  - Clear all checkboxes except for *Internet Protocol (TCP/IP)* and *QoS Packet Scheduler*
  - Click *Properties* for the Internet Protocol component
    - In the Properties dialog for the TCP/IP connection, select *Use the following IP Address*, and specify an address that is different but on the same subnet as the microFlow.net Gas (i.e. if your microFlow.net Gas is 192.168.0.1, make the address for the SLIP client 192.168.0.9 or similar.

Address: A coded representation of the origin or destination of data.

Algorithm: A procedure for solution of a problem in a finite number of steps.

Applications Software: The applications tasks within a system that make the unit conform to the unique circumstances which it must control. Each task within the applications software performs a function corresponding to an external event such as xxx etc.

ASCII (American Standard Code for Information Interchange): This term is pronounced "asky." It is a seven-bit-plus-parity code established by ANSI to achieve compatibility between data services.

Asynchronous Transmission: Transmission in which time intervals between transmitted characters may be of unequal length. Transmission is controlled by start and stop bits at the beginning and end of each character.

Attenuation: The decrease in magnitude of a signal.

Bandwidth: The range of frequencies available for signaling; the difference expressed in Hertz between the highest and lowest frequencies of a band.

Baud: Unit of signaling speed. The speed in baud is the number of discrete conditions or signal events per second. If each signal event represents only one bit condition, baud rate equals bps. When each signal event represents other than one bit, e.g., digit, baud rate does not equal bps.

BCC (Block Check Character): The result of a transmission verification algorithm accumulated over a transmission block. It is normally appended at the end; (e.g., CRC, LRC).

Binary Coded Decimal Representation (BCD): A system of representing decimal numbers, in which each decimal digit is represented by a combination of four digits (bits). For example, the decimal value 6 is represented by 0110 in BCD, the decimal value 15 is represented by 0001 0101.

Binary Digit (bit): A numeral in the binary scale of notation. This digit may be zero or one, which is equivalent to an off or an on position value.

Bit (Binary Digit): Contraction of "binary digit," the smallest unit of information in a binary system. A bit represents the choice between a one or zero condition. Block one or more records considered or transferred as a unit, particularly with reference to input and output.

Block Parity Check: In data transmission, it is an error detection technique, which is used in addition to parity checks. That is, in addition to bits, one or more check characters are added to each message transmitted. When received, if these characters match the one transmitted, the message is assumed correct, otherwise an error is noted.

BPS (Bits Per Second): Unit of data transmission rate.

Buffer: A storage device used to compensate for a difference in rate of data flow or event timing when transmitting data from one device to another.

Buss: One or more conductors used for transmitting signals, data or power. Often a buss acts as a common connection between several locations.

Byte: A binary element string operated upon as a unit and usually shorter than a computer "word." Eight-bit bytes are most common. A byte is also called a "character."

Carriage Return: In a character-by-character printing mechanism, the operation that causes the next character to be printed at the left margin.

Cathode Ray Tube (CRT): A television-like picture tube used in visual display terminals.

CCITT: International Telegraph and Telephone consultative Committee (from the French, Comite Consultatif International Telegraphique et Telephonique). An international consultative committee that sets international communications standards.

Character: The actual or coded representation of a digit, letter or special symbol.

Clock: Shorthand term for the source(s) of timing signals used in synchronous transmission. More generally: the source(s) of timing signals sequencing electronic events.

Code: A system of symbols and rules for use in representing information.

Compiler: A computer program that prepares a machine-language program from instructions or sub-routines written in a high-level language. A compiler usually generates more than one machine instruction for each symbolic instruction.

Computer: A device capable of solving problems by accepting data, performing prescribed operations on the data under direction of a stored program, and supplying the results of these operations.

Conditioning: The addition of equipment to a leased voice grade channel to provide minimum values of line characteristics required for transmission.

Console: The part of a computer that is used for communications between operators or service personnel and the system. The console contains lights, keys, switches, and related circuits for man-machine communication. The console may be used to control the machine manually, correct errors, determine the status of machine circuits, registers, and counters, determine the contents of storage, and manually revise the contents of storage.

Contention: The facility provided by the dial network or a port selector that allows multiple terminals to compete on a first-come-first-served basis for a smaller number of computer ports.

Conversational Mode: A procedure for communication between a terminal and the computer in which each entry from the terminal elicits a response from the computer and vice versa.

CPU (Central Processing Unit): Portion of a computer which directs the sequence of operations and initiates the proper commands to the computer for execution.

CR (Carriage Return): A formatting tool that moves the active position to the first character position of the same line.

CRC (Cyclic Redundancy Check): An error detection scheme in which the check character is generated by taking the remainder after dividing all the serialized bits in a block by a predetermined binary number.

CTS (Clear To Send): Physical modern interface control signal from data communications equipment (DCE) that indicates to the data terminal equipment (DTE) that it may begin data transmission.

Current Loop: Method of interconnecting terminals and transmitting signals, whereby a mark (binary 1) is represented by current on the line and a space (binary 0) is represented by the absence of current.

Data Integrity: A performance measure based on the rate of undetected errors.

Data Set: A device that converts the signals of a business machine to signals suitable for transmission over communication lines and vice versa. It may also perform other related functions.

DC (Device Control): A category of control characters primarily intended for turning on or off a subordinate device. Samples of DC characters are as follows: DC1, DC2, etc. (See X-ON and X-OFF).

DCE (Data Communications Equipment): The equipment that provides the functions required to establish, maintain and terminate a data transmission connection; e.g., a modem.

Debugging: The process of identifying and correcting mistakes in a computer program.

DIP (Dual In-Line Package): An electronic component package characterized by two rows of external connecting pins which are inserted into the holes of the printed circuit board.

DTE (Data Terminal Equipment): The equipment acting as data source, data sink or both.

EIA (Electronic Industries Association): A standards organization in the U.S.A. specializing in the electrical and functional characteristics of interface equipment.

EIA-232C: Interface between data terminal equipment and data communication equipment employing unbalanced voltage digital interface circuits.

EIA-422: Electrical characteristics of balanced-voltage digital interface circuits.

Emulate: To imitate a computer system by a combination of hardware and software that allows programs written for one computer to run on another.

Ethernet: Networking technology popularly used for Local Area Networks (LANs)

ETX (End of Text): A transmission control character which terminates a text.

File Maintenance: The activity of keeping a file up-to-date by adding, changing or deleting data.

Firmware: A computer program or software stored permanently in PROM or ROM or semi-permanently in EPROM.

FTP: File Transfer Protocol, an application layer protocol used on TCP/IP networks especially for moving large files between hosts on the internet.

Full-duplex: Simultaneous, two-way, independent transmission in both directions.

Half-duplex: Transmission in either direction, but not both directions simultaneously.

Handshaking: Exchange of predetermined signals between two devices for purposes of control.

Hardcopy: A printed copy of machine output in readable form, for example, reports, listings, documents, summaries.

HDLC (High Level Data Link Control): The international standard communication protocol defined by ISO.

Header: The control information prefixed in a message text, e.g., source or destination address, sequence number or message length or type.

Hertz (Hz): A measure of frequency or bandwidth. The same as cycles per second.

Hexadecimal Number System: The number system with the base of sixteen. In hexadecimal, the first ten digits are 0 9 and the last six digits are represented by the letters A-F.

HTTP: Hypertext Transfer Protocol; an application-level protocol used widely on the World Wide Web

Impact Printer: A printer forms characters by the use of print hammers that press the paper and ribbon against selected type characters as they pass in front of the paper. Type characters are commonly mounted on a moving chain or are engraved on the face of a rotating drum. Typical speeds range from 500 to 2,000 lines per minute.

ISO: International Standards Organization.

LAN: Local Area Network; A data communications system handling a few nodes up to several hundred, confined to a few buildings within a few thousand meters of one another.

Line Driver: A signal converter which conditions a digital signal to ensure reliable transmission over an extended distance.

Line Turnaround: The reversing of transmission direction from sender to receiver or vice versa when using a half-duplex circuit.

LRC (Longitudinal Redundancy Check): An error detection scheme in which the check character is a 7 bit ASCII character calculated as the exclusive (OR) sum of all characters excluding itself in the packet of transmitted information.

Mark: Presence of signal. In telegraph communication, a mark represents the closed condition or current flowing. A mark impulse is equivalent to a binary 1.

Message Format: Rules for the placement of such portions of a message as message heading, address text, and end of message.

Mnemonic Code: Instructions for the computer written in a form that is easy for the programmer to remember. A program written in mnemonics must be converted to machine code prior to execution.

Modem (Modulator-Demodulator): A device used to convert serial digital data from a transmitting terminal to a signal suitable for transmission over a telephone channel or to reconvert the transmitted signal to serial digital data for acceptance by a receiving terminal.

Multiplexer: A device used for division of a transmission facility into two or more sub-channels either by splitting the frequency band into narrower bands (frequency division), or by allotting a common channel to several different transmitting devices, one at a time (time division).

Noise: In communication theory, an undesired disturbance in a communication system. Noise can generate errors or spurious messages. Contrast with signal.

Null Modem: A device that connects two DTE devices directly by emulating the physical connections of a DCE device.

Off-line: Pertaining to equipment or devices not under direct control of the central processing unit.

On-line: Pertaining to equipment or devices in direct communication with the central processing unit.

Operating System: The operating system supplies all services and utilities to the applications task necessary to run the system efficiently. The operating system provides priorities and schedules of the different applications tasks.

Packet: A group of binary digits, including data and call control signals, which is switched as a whole. The packet information is arranged in a specific format.

Parallel Transmission: Byte-wide data transmission that allocates a data line for each bit in a word. Transmission is usually unidirectional.

Parity Check: Addition of non-information bits to data, making the number of ones in a byte (bit group) either always odd or always even. This permits detection of errors in blocks that have a single error.

Polling: A centrally controlled method of calling a number of devices, by sequential inquiry, to permit them to transmit information.

Port: An interface on a computer configured as data terminal equipment and capable of attaching a modem for communication with a remote data terminal.

Priority or Precedence: Controlled transmission of messages in order of their designated importance; e.g., urgent or routine.

Program: An explicit set of steps or instructions that directs the computer and coordinates the operation of the various hardware components.

PROM (Programmable Read Only Memory): Non-volatile memory chip that allows a program to reside permanently in a piece of hardware.

Protocol: A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems.

Real Time: Pertaining to the actual time during which a physical process takes place. Pertaining to the performance of a computation during a period, short in comparison, with the actual time that the related physical process takes place in order that results of the computations can be used in guiding the physical process.

Queue: A waiting line or area.

RAM: Random Access Memory. Semiconductor read-write volatile memory. Data stored is lost if power is turned off.

Redundancy Check: A technique of error detection involving the transmission of additional data related to the basic data in such a way that the receiving terminal, by comparing the two sets of data, can determine to a certain degree of probability whether an error has occurred in transmission.

Response Time: The elapsed time between the generation of the last character of a message at a terminal and the receipt of the first character of the reply. It includes terminal delay and network delay.

ROM: Read-Only Memory. Non-volatile semiconductor memory manufactured with predefined data content, permanently stored.

RTS (Request to Send): Physical modem interface control signal from DTE, requesting clearance to transmit.

SLIP (Serial Line Internet Protocol): The microFlow.net Gas communications ports communicate with a minicomputer type device using TCP/IP over a serial communications line.

Secondary Storage: A storage that principally supplements primary storage. Secondary storage devices include magnetic disk units, magnetic drums, and magnetic tape. Secondary storage is characterized by slower speed of operation and correspondingly lower cost than those related to primary storage.

Sector: A portion of a track (from a magnetic disk) whose shape is similar to a slice of pie. Each track is equally divided into sectors, in which each sector may have its own distinct address.

Serial Transmission: A method of data transmission in which each bit of information is sent sequentially on a single data channel. Serial transmission is the normal transmission mode for data communications.

Signal: In communication theory, an intentional disturbance in a communication system. Contrast with noise.

Simplex Transmission: Data Transmission in one direction only.

Single-Address Message: A message to be delivered to only one destination.

Start Bit: In a synchronous transmission, the last bit or element in each character, normally a mark, to which is assigned a minimum duration during which the receiving equipment is returned to its rest condition in preparation for the reception of the next character.

Start Bit: In asynchronous transmission, the first bit or element in each character, normally a space, which prepares the receiving equipment for the reception and registration of the character.

Stop Bit: In start-stop transmission, the last bit or element in each character, normally a mark, to which is assigned a minimum duration, during which the receiving equipment is returned to its rest condition in preparation for the reception of the next character.

Storage: A general term for any device capable of retaining information.

STX (Start of Text): A transmission control character which precedes a text and which is used to terminate a heading.

Synchronous Transmission: Transmission where the data characters and bits are transmitted at a fixed rate with the transmitter and receiver synchronized. Synchronous transmission eliminates the need for start and stop bits.

Table: An organized collection of data, usually arranged in an array where each item in the array is uniquely identifiable by some label or by its relative position. Items in a table are easier to locate or identify, and thus provide a ready reference.

TC (Transmission Control): Category of control characters intended to control transmission of information over telecommunication networks. Samples of TC characters are as follows: ACK, DLE, ENQ, EOT, ETB, ETX, NAK, SOH, STX and SYN.

TCP/IP: Transfer Control Protocol/Internet Protocol; protocol used to reliably send messages across a network or the internet.

Voice Grade Channel: A channel suitable for transmission of speech, digital or analog data, or facsimile, generally with a frequency range of about 300 to 3000 Hertz.

Word: A set of characters that occupies one storage location and is treated by the computer circuits as a unit and is transported as such. Word lengths are fixed or variable, depending on the particular computer and program.

X-OFF (Transmitter Off, DC3): The communication control character used to instruct a terminal to suspend transmission.

X-ON (Transmitter On, DC1): The communication control character used to instruct a terminal to start or resume transmission.

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