Serial Comunications Manual

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In the event of a defect during the warranty period, the unit should be returned, freight prepaid (and all duties and taxes) by the Buyer, to the authorized UniMeasure distributor where the unit was purchased. The distributor, at its option, will repair or replace the defective unit. The unit will be returned to the buyer with freight charges prepaid by the distributor.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from:

1. Improper or inadequate maintenance by Buyer.
2. Unauthorized modification or misuse.
3. Operation outside the environmental specifications of the product.
4. Mishandling or abuse.

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1.0 INTERFACE INFORMATION

The series of DPMs and counters offers RS232 or RS485 serial communication interface boards that may be connected by cable to computers, remote displays, printers or other digital devices having similar serial communication capability. Software is available for use with an IBM-compatible PC/XT/AT computer that simplifies the logging of measurement data on the computer and provides capability for the remote setting of parameter values in lieu of using the front panel menu setup.

2.0 SERIAL COMMUNICATION FORMAT

The serial communication format for both RS232 and RS485 is the following:

Mode	Full Duplex (Separate transmit and receive lines) and Half Duplex (RS485 only)
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200 selectable by front panel Menu item "Ser 1", Sub-menu item "Digit 4" for DPM, "Digit 5" for counter.
Parity	None
Word length	8 data bits
Stop bit	1

The baud rate can be set from the front panel Menu item, "Ser 1", according to the following coded table:

Digit 4 for DPM Digit 5 for counter	Baud rate
0	300
1	600
2	1200
3	2400
4	4800
5	9600
6	19200

2.1 MEASUREMENT DATA FORMAT

The basic measurement data format consists of 8 ASCII characters:
(shown for DPM, add 1 more digit for counter)

+999.99<cr> where <cr> is the carriage return character

Notes: The first character is always a plus or minus sign, and a decimal point is always furnished, even when it follows the last digit and is not required.

Adding a Line Feed Character to the Basic Format

Printers and other devices that receive the measurement data sometimes require a line feed

character <lf> following the carriage return character <cr>. This can be added to the data format shown above by setting the front panel Menu item “Ser 2”, ”Digit 2" to a “1” and removed by setting to a “0” ("Digit 3" for counter).

Adding a Coded Data Character to the Basic Format

It is also possible to add a coded character to the data format to indicate the alarm, overload and zero-blanking status of the meter. If used, this character precedes the <cr> so it is the last printable character in the format (<cr> and <lf> are control characters and are not printable). This coded character can be added to the data format shown above by setting the front panel Menu item “Ser 2”, ”Digit 3" to a “1” and removed by setting to a “0” ("Digit 4" for counter).

The measurement data format with both of these parameters set consists of 10 characters:

+999.99A<cr><lf>
***** ***** ***** = optional character

The coded character preceding the carriage return is a letter from A to P. It supplies the alarm, overload and zero-blanking status of the meter according to the following table:

Alarm Status	Zero Blanking		No Zero Blanking	
	No overload	Overload	No overload	Overload
Neither Alarm set	A	E	I	M
Alarm 1 set only	B	F	J	N
Alarm 2 set only	C	G	K	O
Both Alarms set	D	H	L	P

For example, a coded character “G” indicates that Alarm 2 only is set, the DPM is in the overload condition and zero blanking has been selected. This information is useful when the output data is supplied to a computer for listing and analysis or when it is supplied to a Remote Display in a Master-Slave configuration.

The Counter is capable of supplying more than 1 measurement value each reading. Depending on the selected Function, there can be 1,2 or 3 active measurement values plus a peak value. The values transmitted are selected by Menu item “Ser 3” “Digit 6” according to the following table.

Digit 6	Values Transmitted
0	All active items
1	Item #1 only
2	Item #2 only (if active)
3	Item #3 only (if active)
4	Peak only
5	All active items plus peak

These values are sent in a continuous string with no space between them. If Menu item “Ser

3" "Digit 5" = 1, the termination characters of <CR> and optional <LF> appear at the end of each value. If it = 0 then the termination characters appear only once at the end of the string. In either case, the coded character, if included, appears at the end of the last value only.

3.0 CABLE CONNECTIONS

The word "modular" used in here refers to telephone-type extension cable and connections.

To connect a single meter to the computer you will need:
1. A modular extension cable.
2. A modular adapter that contains a modular receptacle for the cable and has either a 9 pin or 25 pin subminiature D connector that is plugged into the computer.

To connect 2 or more meter s to a computer you will need as a minimum:
1. The same two items as above.
2. A modular tee-adapter and one STRAIGHT-THRU (See CAUTION next page) modular extension cables for each DPM.

The RS-232 and RS-485 boards contain modular (telephone) interface connectors to allow low-cost telephone-type cable to be used for wiring between the DPM and a host computer or other DPM's. A modular adapter with programmable wiring to a subminiature D connector, either 9-pin or 25-pin, as required, may be used to facilitate connection to the computer.

CAUTION: There are two common types of modular extension cables, those wired STRAIGHT-THRU for data applications and those wired in REVERSE or CROSS-PINNED for telephone extensions. The REVERSE type is normally found at Radio Shack or in the telephone accessories department of variety stores. The STRAIGHT-THRU type can be purchased from computer supply stores or from catalogs listing communications accessories such as Black-box and L-Com. See section 8.0 for sources of cables.

3.1 SELECTING THE MODULAR CABLE TYPE.

Application	Cable Type
Computer to single meter	Use either STRAIGHT-THRU or REVERSE modular cables and then wire the modular-to- subminiature D connector adapter that plugs into the computer according to the one that was selected.
Computer to multiple meters (multi-drop)	Use only STRAIGHT-THRU modular cables with modular "tee" adapters.
Meter (Master) to meter (Slave)	Use only a REVERSE modular cable to connect transmit of Master to receive of Slave.
Meter (Master) to multiple meters (Slaves)	Use a REVERSE modular cable from the Master to the first modular "tee" and STRAIGHT-THRU modular cables for all remaining connections.

The cable connections to an IBM PC-compatible computer are different for RS232 and RS485.

RS-232

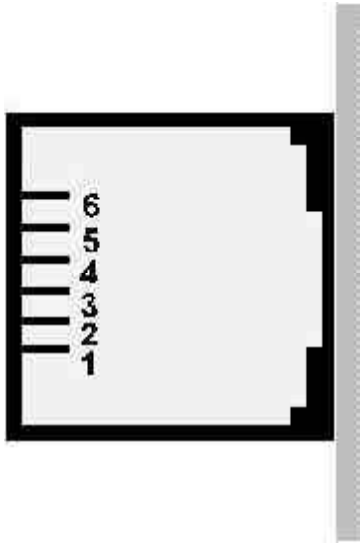
The RS232 cable connections at the computer end may interface with either a 25-pin or a 9-pin subminiature D connector. Both are commonly used and have pin connections as shown below.

RS-232

METER		IBM COMPUTER		
Signal Name	6-pos, 4-wire Modular Plug	Signal Name	25-pin D Sub-miniature	9-pin D Sub-miniature
RX Receive	4 (5)*	TX Transmit	2	3
TX Transmit	3 (2)*	RX Receive	3	2
RTS Handshake	2 (3)*	RTS Handshake	4	7
Isolated Ground	5 (4)*	Isolated Ground	7	5

***** If a modular adapter with programmable wiring to a subminiature D connector is being assembled using "poke home" contacts, the above pin contacts should be used straight across provided a STRAIGHT-THRU modular extension cable is used. However, if a REVERSE or CROSS-PINNED modular extension cable is used, the vertical order of the pin numbers for the 6-pos, 4-wire Modular Plug must be reversed as shown by numbers in parenthesis.

Note: The IBM computer normally has male RS-232 connectors so the modular adapter should have a female connector.



Rear View of Modular Jack
(mounted on meter RS-232 or RS-485 board)

RS-485

The RS-485 cable connections at the computer end may vary according to the manufacturer of the RS-485 computer interface board installed in the computer. The following pin connections are for a Qua Tech Model DS225/325 board that internally plugs into an IBM compatible computer and uses a 9-pin Subminiature D connector for the RS-485 interface. Other manufacturers and models may be different. Consult your manual for the board installed.

RS-485

Meter		IBM COMPUTER	
Signal Name	6-pin Modular Plug	Signal Name	9-pin D Sub-miniature
ATX Transmit+	3	Data In+	4
BTX Transmit-	2	Data In-	8
Isolated Ground	1,6	Ground	3
ARX Receive+	4	Data Out+	2
BRX Receive-	5	Data Out-	7

Another alternative for RS-485 is to use an RS-232 to RS-485 converter that plugs into the computer RS-232 receptacle external to the computer and is powered from a +9V DC wall plug-in adapter. One such unit is the K & C IC-11/F (See Section 7.0 for a source listing).

RS-485

Meter		K & C IC-11/F RS-232 TO RS-485 ADAPTER	
Signal Name	6-pin Modular Plug	Signal Name	Screw terminal Pin #
ATX Transmit+	3	R-	4
BTX Transmit-	2	R+	3
Isolated Ground	1,6	Ground	n/c
ARX Receive+	4	T-	2
BRX Receive-	5	T+	1

For multi-drop, use STRAIGHT-THRU modular cables and modular “tees” to connect all of the DPM’s in parallel.

4.0 SYSTEM CONFIGURATIONS

The meters operate in a Point-to-point mode using RS-232 or RS-485. In addition, they can operate in a Multi-point mode using RS-485.

Point-to-point mode is a direct connection between a computer or other digital device and the meter.

Multi-Point mode is a connection from a host computer to a multiplicity of meters bussed together with their inputs and outputs connected in parallel. The end meters on the bus should have jumpers **c**,**d**, **e**, and **f** in place on the RS-485 option boards and the same jumpers should be removed from all other meters on the bus. It is necessary to set up each meter on the bus with a different address from 1 to 31. To command a particular meter, its address is used in conjunction with the command and only that meter responds. The outputs of all of the meters on the bus are set to a high impedance state except the meter addressed.
The meter addresses range from 1 to 31 with 0 being a special address to which a meter responds only internally (e.g. Reset) but does not transmit any response on the output lines.

All meters may be commanded simultaneously with a 0 address and there will not be any output response contention.

Addressing of the meters can be done from the front panel using Menu item “Ser 2”, ”Digit 5" for the DPM and "Digit 6" for the counter. The 1-31 addresses are selected from one digit position of the display by using the following format:

Ser 2	Address
1 -9	1- 9
A -F	10-15
0.-9.	16-25
A.-F.	26-31

A meter operating in a point-to-point mode must also be addressed. Although any address will suffice, it is suggested address = 1 be selected as a standard for the point-to-point mode. Address= 0 should be avoided because a meter with this address will not transmit a response to a command.

5.0 OPERATING MODES

The meters operate in two serial communication modes.

5.1 CONTINUOUS MODE

In this mode, measurements are continuously transmitted by the meter in a standard data format using printable ASCII characters and at a selectable rate extending from the line frequency down to one measurement every 72 seconds. This data may be received by a remote display at a distant location, or by a printer for data logging purposes, or by a host computer for data analysis or system control.

DPM ONLY

The transmission rate of measurement data can be selected from the front panel Menu item “Ser 1”, ”Digit 5". The meter conversion rate should equal AC power frequency (50 or 60 Hz). Any baud rate may be used but if less than the minimum baud rate in the table, the transmission rate will decrease accordingly. Time intervals (reciprocal of rate) between transmissions are:.

Ser 1 Digit 5	60 Hz	50 Hz	Minimum Baud rate
0	.018 s	.021 s	9600
1	.28 s	.34 s	600
2	.57 s	.68 s	300
3	1.1 s	1.4 s	300
4	2.3 s	2.7 s	300
5	4.5 s	5.4 s	300
6	9.1 s	10.9 s	300
7	18.1 s	21.8 s	300
8	36.3 s	43.5 s	300
9	72.3 s	86.7 s	300

COUNTER ONLY

The transmission rate of measurement data can be selected from the front panel Menu item “Ser 1” “Digit 6”. Data transmission is initiated at the end of the calculation time following the gate time. Data is completely transmitted for one measurement before the calculation of the next measurement is started. Therefore, the reading rate is influenced by the baud rate, the number of items transmitted and gate time. If the selected gate time is less than that shown in the table below, it is not the determining factor of the reading rate. If it is greater, then it is the determining factor. Time intervals (reciprocal of rate) between transmissions at the reading rate are:

BAUD	TIME 1 ITEM	MIN GATE	TIME 2 ITEMS	MIN GATE	TIME 3 ITEMS	MIN GATE	TIME 4 ITEMS	MIN GATE
300	.37s	.34s	.70s	.67s	1.03s	1.00s	1.37s	1.34s
600	.18s	.15s	.35s	.32s	.52s	.49s	.68s	.65s
1200	.09s	.06s	.18s	.15s	.26s	.23s	.34s	.31s
2400	.05s	.02s	.09s	.06s	.13s	.10s	.17s	.14s
4800	.02s	.01s	.04s	.01s	.07s	.04s	.09s	.06s
9600	.01s	.01s	.02s	.01s	.03s	.01s	.04s	.01s
9200	.01s	.01s	.01s	.01s	.02s	.01s	.02s	.01s

The data transmission rate may be reduced by sending data every other reading, every fourth reading, or less, according to the following table. This selection is made with Menu item “Ser 1” “Digit 6”.

Ser 1,Dig 6	Transmission Rate
0	Reading Rate
1	Reading Rate/2
2	Reading Rate/4
3	Reading Rate/8
4	Reading Rate/16
5	Reading Rate/32
6	Reading Rate/64
7	Reading Rate/128

A computer, if busy with other tasks, may be unable to keep up with the faster data rates of the meter, so a handshake function is available that provides the computer with control over the meters’ data transmissions. Both hardware (RTS) and software (XON/XOFF) handshaking are available for the RS232 option but neither is available for the RS485 option.

RTS

he DPM and Counter hve 2 modes for RTS control, unlatched and latched. In the unlatched mode for the DPM, the measurement transmission is enabled by a high RTS level, and disabled by a low RTS level. When disabled, any character being sent is completed and when enabled any characters remaining in the data format are transmitted before the next measurement transmission. The computer, when its receive buffer is nearly full, takes the RTS line low to halt data transmission. When its receive buffer has emptied, it takes the RTS line high to enable more data transmissions. Some measurements could be missed in the process. The latched and unlatched mode are selected by "config" "digit 2" in the DPM andin the counter by “Ser 3”

.

“Digit 4” which = 0 for unlatched and = 1 for latched. The unlatched control for the Counter is the same as the DPM description except that the current measurement is held until the previous data transmission is complete.

With latched control, the RTS input is polled every 3.3mS and when a high level is detected, RTS is latched true, even though the RTS line goes low immediately. At the end of each calculation, the latched RTS value is checked and if it is true, a complete measurement transmission (from one to four values) is made without interruption regardless of the state of the RTS line during that time. At the end of the complete transmission, the latched RTS value is reset false, even though the RTS line may be high at that instant. The RTS latch does not go true again until the RTS line is first returned to a low level after the completion of the transmission and then is taken high again. Latched control provides “print command” operation by sending a transmission for each RTS pulse. If a second pulse occurs during the transmission, it is not recognized.

XON/XOFF
A measurement transmission is enabled by the receipt of an ASCII XON character, and disabled left open or jumpered to a high level for better noise rejection.

COMMAND MODE -
In this mode, the meter does not send any data automatically, but instead responds to commands it receives from the host computer. These commands can be:

To transmit the latest or peak measurement,
To reset itself completely or just the peak value and/or the latched alarms,
To display a value sent from the computer,
To transmit present setup parameters,
To receive new setup parameters, and
To monitor or alter data in selected memory locations of the meter.

The selection of either the Continuous mode or the Command mode can be made from the front panel Menu selection “Ser 2”, ”Digit 4" for the DPM and "Digit 5 for the counter where:

“0” = Continuous mode
“1” = Command mode

Note: The meter will not respond to a command in the Continuous mode except the command “A1” which puts the meter into the Command mode.

5.2 COMMAND MODE

The command mode formats are required only by those users desiring to write custom software for reading or controlling the meter or changing setup parameters. Software is available that is easy to use and doesn’t require programming for those that can accept the format in which it is presented. For those wishing to do their own custom programming using the meter’s commands, the following information lists the commands and their format.

Note (for the Counter only): After any command that causes a Meter Reset such as C0, F, W, X, the Counter sends an “R” character after the Reset is complete and the Counter is ready to accept a new command.

The minimum format is 4 characters:
Example: ✶5A1
All commands begin with "✶" followed by the meter address, then a command letter followed by a sub-command number or letter. Additional characters may be appended. All commands terminate with <cr>. <lf> ignored.

CHAR #	CHARACTER	DESCRIPTION
1	✶	Command Identifier (Recognition Character)
2	0-V	Device Address (0 addresses all devices, 1-V specific)
3	A-Z	Command Function
4	0-U	Sub-command (or # Bytes or Words of data being transferred)

CHAR 2 - ADDRESS CODES
The next table is the Serial Communication Address Codes following the "✶" for each meter address number. Also shown is the corresponding Menu character that is set for menu item "SER 2", sub-menu item "Digit 5"for the DPM and "Digit 6" for the counter.

Meter #	Menu SER 2 Digit 5(6)	Serial Comm Address Code
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	A	A
11	B	B
12	C	C
13	D	D
14	E	E
15	F	F

Meter #	Menu SER 2 Digit 5(6)	Serial Comm Address Code
16	0.	G
17	1.	H
18	2.	I
19	3.	J
20	4.	K
21	5.	L
22	6.	M
23	7.	N
24	8.	O
25	9.	P
26	A.	Q
27	B.	R
28	C.	S
29	D.	T
30	E.	U
31	F.	V

CHARS 3 & 4 - COMMANDS AND SUBCOMMANDS

The examples below use a default address of 1 following the " ✶". Substitute the desired address from the above table of Serial Comm Address Codes. All command sequences shown must terminate with <CR>.

5.2.1. COMMUNICATIONS MODE

Continuous mode -✶1A0
Command mode - ✶1A1

5.2.2. REQUEST DPM VALUE

Latest reading - ✶1B1
Peak value - ✶1B2

REQUEST COUNTER VALUES

All active items -✶1B0
Item 1 -✶1B1
Item 2 -✶1B2
Item 3 -✶1B3
Peak -✶1B4
All active items + peak -✶1B5

5.2.3. RESET FUNCTIONS -DPM

Cold reset - ✶1C0 (Reads NVMEM into RAM locations after RAM zeroed)
Warm reset - ✶1C1 (RAM undisturbed but program initialized)
Latched alarms reset - ✶1C2
Peak value reset - ✶1C3
Remote display reset - ✶1C4

RESET FUNCTIONS -Counter

Cold reset -✶1C0 (Reads NVMEM into RAM locations after RAM zeroed)
Function reset - ✶1C1 (Resets all total values and/or peak value)
Latched alarms reset - ✶1C2
Peak value reset - ✶1C3
Remote display reset - ✶1C4 (Resets Item 3 to zero if not Arith or Batch) (and removes Alarm View or Peak View if on)
External Input B true - ✶1C5
External Input B false - ✶1C6

5.2.5 READ AND WRITE TO RAM AND NON-VOLATILE MEMORY

CHARACTER 2

This Meter Address Code is the same as address codes shown above

CHARACTER 3

Command character

- G Read bytes from RAM Memory
- F Write bytes to RAM Memory
- X Read words from Non-Volatile Memory
- W Write words to Non-Volatile Memory

CHARACTER 4

Code for number of bytes or words

Code #	Code #	Code #	Code #
1 = 1	9 = 9	H = 17	P = 25
2 = 2	A = 10	I = 18	Q = 26
3 = 3	B = 11	J = 19	R = 27
4 = 4	C = 12	K = 20	S = 28
5 = 5	D = 13	L = 21	T = 29
6 = 6	E = 14	M = 22	U = 30
7 = 7	F = 15	N = 23	
8 = 8	G = 16	O = 24	

CHARACTERS 5,6

See tables in Section 6 for the RAM MEMORY ADDRESSES and NON-VOLATILE MEMORY ADDRESSES with their respective data definitions.

(1) READ AND WRITE RAM MEMORY DATA

RAM memory data is read and written as a continuous string of bytes consisting of 2 hex characters (0-9,A-F) per byte. Included in the command is the total number of bytes to be transferred and the most significant address in RAM of the continuous string of bytes. The format is:

Read RAM data ✶1Gnaa (followed by WARM reset)
Write RAM data ✶1Fnaa(data)
where: n is the number of bytes to be read or written.
aa is the most significant address in RAM of the bytes to be read or written.
data is n bytes of 2 hex characters per byte in order from the most to the least significant byte.
The number of bytes n consists of a single character representing values from 1 to 30 as shown above under CHARACTER 4.
The most significant address aa consists of 2 hex characters as shown below under RAM MEMORY ADDRESSES AND DATA DEFINITIONS.

(2) READ AND WRITE NON-VOLATILE MEMORY DATA

NON-VOLATILE data is read and written as a continuous string of words consisting of 2 bytes or 4 hex characters (0-9,A-F) per word. Included in the command is the total number of words to be transferred and the most significant address in non-volatile memory of the continuous string of words. The format is:

Read non-volatile memory data - ✶1Xnaa (followed by WARM reset)
Write non-volatile memory data - ✶1Wnaa (data)
where: n is the number of words to be read or written.

aa is the most significant address in non-volatile memory of the words to be read or written

data is n words of 2 bytes or 4 hex characters per word in order from the most to the least significant address

The number of words n consists of a single character representing values from 1 to 30 as shown under CHARACTER 4.
The most significant address aa consists of 2 hex characters as shown below under NON-VOLATILE MEMORY ADDRESSES.

5.3 REMOTE DISPLAY COMMAND FORMAT

1. DPM

DATA FORMAT

*1HSDDDDD.A S = Sign, either blank (for +) or -
D = Digit from 0 to 9, five digits total. Always include a decimal point even though it comes at the end.
A = Alarm character as defined in 2.1 above.

REMOTE DISPLAY

A DPM may serve as a remote display that responds to values sent by a PC Controller (E.G. an IBM PC/XT/AT personal computer) with serial communications or to another DPM in a Master/Slave configuration. There are 3 modes in which the DPM may act as a remote display.

MODE 1
DPM with Signal Conditioner card and not in Remote Display mode.

SETUP (left digit) = 0 4 1/2 Digit DPM
= 2 4 1/2 Digit DPM with Count by 10
= 3 3 1/2 Digit DPM

The baud rate must be set the same as the source. The PC Controller uses the H command to cause the display to halt it's normal readings and display the value sent by Serial Communications instead. The DPM must be in the Command mode to receive the data. The data format sent via Serial Communications is:

*#HSDDDDD.A <CR> where the decimal point is in front, behind (as shown), or between the D's (digits).

An exact total of 11 characters plus a CR must be included and sent as Ascii characters. Those in quotes below are included as shown. The other symbols represent a range of characters except for CR which is the Ascii character "0D".

* = Command identifier
# = Device address from 1 to 9, A to V, or 0 for common address
H = Command letter

S = Sign of value, space (or +) for positive, - for neg value
D = Digit from 0 to 9
. = Decimal point placement and must always be included
A = Alarm and overload character code, A to H
<CR> = Carriage return character

The following table lists the Alarm and Overload characters.

ALARM CONDITION	NO OVERLOAD	OVERLOAD
Neither Alarm on	A	E
Alarm 1 only on	B	F
Alarm 2 only on	C	G
Alarms 1 & 2 on	D	H

If the DPM is in the Continuous mode, it must be put into the Command mode by sending ✶#A1 prior to sending the remote display value.
The Remote Display value remains on the display until one of the following occurences:

a. The command ✶#C4 is sent removing the Remote Display value and returning to the normal readings without resetting the DPM.
b. The command ✶#C0 is sent causing a Cold Reset of the DPM.
c. The command ✶#C1 is sent causing a Warm Reset of the DPM.
d. Front panel pushbuttons RESET and MENU are simultaneously pushed to cause a Cold Reset of the DPM.

Notes:
After the Remote Display value is entered, the DPM can be put back in the Continuous mode with the command ✶#A0 without disturbing the display's value. DPM must be in the Command mode for a., b., or c. above. It may be put into the Command mode while displaying a remote display value with the ✶1A1 command without affecting the display.
If PEAK (manual or external) or ALARM VIEW (manual) is activated while the remote value is being displayed, the peak or alarm value is displayed and cannot be removed except by Remote Display Reset (a., b., or c. above in Command mode) or by manual RESET. If a Remote Display value is sent while in PEAK or ALARM VIEW, it is ignored, but when PEAK or ALARM VIEW is turned off, the Remote Display value comes on.

MODE 2
DPM with Signal Conditioner card and in Remote Display mode.

SETUP (left digit) = 1 Remote Display mode
The baud rate must be set the same as the source which may be a PC Controller or another DPM.

The format is the Slave Format. This is the same as MODE 1 above but without

the Command Identifier "*", the address #, and the Command letter "H". This is the same format that data is transmitted from a DPM in the Continuous mode. The string of characters must be exactly 8 characters plus the CR in length.

SDDDDD.A <CR>

No commands can be received in this mode but the front panel MENU can be accessed. Any transmissions received other than properly formatted data will result in a meaningless display. Alarm setpoints, Peak readings and external control functions are disabled while the Remote Display value is being displayed. When the DPM is Reset, it displays RESET continuously until data is received.

2. COUNTER

The Counter has 12 Display Modes (0-11). Modes 0-5 are normal measurement modes and Modes 6-11 are dedicated to Remote Display only without making any normal readings. In any of the 12 modes, remote display data may be received via RS-232 or RS-485 serial communications and displayed. The remote data requirements and the Remote Display capabilities vary for the different display modes and selected Input Functions. The mode is selected by Menu item "ConFiG" "Digit 3" from the following list.

Normal Readings While Displaying Remote Data		Addressable Commands
0	Normal display, Exponent Overflow	H,K or L
1	Normal display, 999999 Overflow	H,K or L
2	1 Right-hand dummy zero	H,K or L
3	2 Right-hand dummy zeros	H,K or L
4	Real time clock, multi-format	H,K or L
5	Real time clock, hh.mm,ss	H,K or L

Remote Display Only - No Normal Readings		Addressable Commands
6	Addressable remote display	H,K or L commands
	Data Requirements	
7	Single value remote display	1 Value only
8	1st value of value sequence	1-4 sequential Values
9	2nd value of value sequence	2-4 sequential Values
A	3rd value of value sequence	3-4 sequential Values
B	4th value of value sequence	4 sequential Values

The addressable commands of Modes 0-6 can display remote data on one or more Counters having the command addresss in a multi-point configuration or a single Counter having the command address in a Point-to-point configuration. Modes 7 - 11 (B) do not use addressable commands, but values only. They are primarily designed for Host Counter to Slave Counter remote display applications but may be used also in Host Computer to Remote Display Counter configurations. Since the Host Counter may be selected to transmit up to four sequential measurement values (Item 1, Item 2, Item 3 and Peak) each measurement cycle, Modes 8-11 provide the ability of the Remote Display Counter to extract one of

four sequential values and display it.

Modes 0-5 are normal counter modes that may be commanded as follows:

1. H Command. Override the normal display reading only.
2. K Command. The value is not displayed but stored as Item 3 if Item 3 is not being used, where it may become the source, if selected, for the Alarm comparison and the Analog Output. Item 3 is used only for the Batch and Arithmetic functions.
3. L Command. Both 1 and 2.

In addition, the H, K, L commands may or may not include a coded Alarm character. If included, it always overrides the internal Alarm comparisons and determines the alarm indicators, the relay operation and the alarm character sent with the serial communications. Readings continue to be made internally during Remote Display operation and may be received by a Host Computer, manipulated, and returned as remote data. When reset by a ✶1C4 Command, the display returns to its internal readings, the Alarms to its internal comparisons, the Analog Output to zero and the Item 3 value to zero. A signal conditioner board must be present in these modes to return to normal readings. If no signal conditioner board is present, any Mode setting from 0-5 automatically changes to Mode 6.

Modes 6-11 are used for remote display only. No normal readings are made. A signal conditioner board is optional, and if present, is ignored. When reset, the display shows “rESEt” until the first remote display data is received.

Mode 6 is an addressable remote display mode that uses the H, K, L commands. Mode 7 is not addressable and data representing a value to be displayed is received in a Pt-Pt connection. Besides displaying the value, it is put into Item 3 where it may be selected for Alarm comparisons and for Analog Output. If a Coded Alarm character is included it overrides the internal alarm comparisons.

Modes 8-11 are able to extract one value of data from a sequence of values and display that particular value only. It could be one of several slave counters connected to a Host Counter, each displaying a different Item value. Also, the extracted value is put into Item 3 where it may be selected for Alarm comparisons and Analog Output. If a Coded Alarm character is included at the end of the sequence, it is ignored.

The remote display reading can only be changed by Meter Reset, a ✶1C4 Remote display reset command or another remote display H or L command.

DATA FORMATS

The basic two Command formats of the data sent via Serial Communications are:

✶#CSDDDDDD.A<CR><LF> where the decimal point is to the right of any one of the D’s (digits).

✶#CSD.DDDEPA<CR><LF> this is the exponential format. The decimal point is fixed. Alarm comparison and Analog Output are not valid in this format.

*	=	Recognition character
#	=	Device address from 1-9, A to V, or 0 for common address.
C	=	Command letter H, K, L.
S	=	Sign of value, space (or +) for positive, - for neg value. Sign is optional in display modes 0-7, required in 8-11.
D	=	Digit from 0 to 9. Number of digits may be 1-6 in display modes 0-7, but must be 6 in 8-11.
P	=	Power of 10. 0-9, A-F where A-F represents 10-15
A	=	Optional Alarm Character as defined in section 2.1
<CR>	=	Carriage return character
<LF>	=	Optional line feed character (ignored)

These basic Command formats are used when the Remote Display Counter is in display modes 0 - 6.
The basic Data formats are the same except *#C is omitted. The basic Data formats are used in display mode 7.

Single or multiple (2-4) Data formats are used in display modes 8-11.
E.g. SDDDDDD.SDDDDDD.SDDDDDD.SDDDDDD.A<CR><LF>
<LF> optional, "Ser 3" "Digit 5" = 0 Term. chars only at end of data string or
SDDDDDD.<CR><LF>SDDDDDD.<CR><LF>SDDDDDD.<CR><LF>SDDDDDD.A<CR><LF>
"Ser 3" "Digit 5" = 1 Term. chars at end of each data item

6.0 MEMORY ADDRESSES AND DATA DEFINITIONS

6.1 DPM

1-BYTE RAM DATA TABLE

Hex Address	Item Name	Hex Value
BF	Configuration	Bit 7 6 5 4 3 2 1 0 0 = Linear Data 1 =Custom Curve (Extended DPM) 0 = Full Duplex (RS485) 1 = Half Duplex 0 = Un-Latched RTS 1 = Latched RTS 0 = Setup scale method 1 = Reading 2 coord method 0 0 0 = Not Rate 0 0 1 = Rate X 0.1 0 1 0 = Rate X 1 0 1 1 = Rate X 10 1 0 0 = Rate X 100 1 0 1 = Rate X 1000 1 1 0 = Rate X 10,000 0 = Not used

34	Analog Setup	Bit 7 6 5 4 3 2 1 0 bit 0 = Analog Out Unfiltered 1 = Analog Out Filtered 0 = Current Output 1 = Voltage Output 0 0 0 0 0 0 = Not used
35	Decimal point	01 Byte values in hex XXXXX. 02 (2 hex characters/byte) XXXX.X 03 XXX.XX 04 XX.XXX 05 X.XXXX 06 XXXXX
34	Lockout	Bit 7 6 5 4 3 2 1 0 bit = 0 is unlocked for all items 1 = SEr 1, Ser 2 locked 1 = An Lo, An Hi locked 1 = Alarm setpoint programming locked 1 = ALSEt locked 1 = Front panel DPM Reset locked 1 = Front panel Peak & Alarm Reset locked 1 = View Alarm setpoints locked 1 = View Peak value locked
33	Lockout	Bit 7 6 5 4 3 2 1 0 bit = 0 is unlocked for all items 1 = OFFSt locked 1 = SCALE, Lo In, Lo Rd, Hi In, Hi Rd 1 = FILtr locked locked 1 = SEtuP, dEC.Pt locked 1 = InPut locked 0 0 0 = Not used
32	Serial Cnfg	Bit 7 6 5 4 3 2 1 0 X X X X X = DPM address 0-31 (5 bits) 1 = Command mode (0 = Continuous mode) 1 = Alarm data included with reading (0=excluded) 1 = LF following CR (0= no LF)
31	Serial Cnfg	Bit 7 6 5 4 3 2 1 0 Continuous Output Data Rate 60 Hz 50 Hz 0 0 0 0 .017s 02s 0 0 0 1 .28 .34 0 0 1 0 .57 .68 0 0 1 1 1.1 1.4 0 1 0 0 2.3 2.7 0 1 0 1 4.5 5.4 0 1 1 0 9.1 10.9

31	Serial Cnfg (continued)	Bit 7 6 5 4 3 2 1 0 Continuous Output Data Rate 0 1 1 1 18.1 21.8 1 0 0 0 36.3 43.5 1 0 0 1 72.3 86.7 0 0 0 300 baud 0 0 1 600 baud 0 1 0 1200 baud 0 1 1 2400 baud 1 0 0 4800 baud 1 0 1 9600 baud 1 1 0 19200 baud 1 = Send filtered value (0= send unfiltered value)
30	Options	Do Not Use. This byte determined by option boards installed
2F	Filter	Bit 7 6 5 4 3 2 1 0 0 0 0 0 Auto Filter 0 0 0 1 Batch (16 samples) filter Time constant 60 Hz 50 Hz 0 0 1 0 Moving Average .07s .085s 0 0 1 1 Moving Average .14 .17 0 1 0 0 Moving Average .28 .34 0 1 0 1 Moving Average .57 .68 0 1 1 0 Moving Average 1.13 1.36 0 1 1 1 Moving Average 2.27 2.72 1 0 0 0 Moving Average 4.53 5.44 1 0 0 1 Moving Average 9.06 10.88 1 0 1 0 Unfiltered 1 = High adaptive threshold(0 = low threshold) 1 = Display filtered signal(0 = display batch) 1 = Take peak of filtered signal(0 = unfiltered) 1 = Alarm from filtered signal(0 = unfiltered)
2E	Setup	Bit 7 6 5 4 3 2 1 0 EXT IN A EXT IN B 0 0 0 Reset Meter Hold 0 0 1 Reset Peak Display 0 1 0 Meter Hold Peak Display 0 1 1 Meter Hold Tare 1 0 0 Peak Display Tare 1 0 1 Tare Reset 1 1 0 External Decimal Point 1 1 1 1 External Decimal Point 2 1 = Coords of 2 points for scale,offset 0 = Scale and Offset direct parameters 1 = Display leading zeroes (0 = blank zeroes) 1 = 50 Hz DPM power (0 = 60 Hz power)

2E	Setup (Cont'd)	Bit 7 6 5 4 3 2 1 0 0 0 4 1/2 digit display, .1 deg for temp 0 1 Remote display 1 0 4 1/2 digits count by 10, .01 deg for RTD temp 1 1 3 1/2 digit display, 1 deg for temp
2D	Input type	Byte values in hex (2 hex characters/byte) Thermocouple 40 = J deg F 41 = J deg C 42 = K deg F 43 = K deg C 44 = N deg F 45 = N deg C 46 = T deg F 47 = T deg C 48 = E deg F 49 = E deg C 4A = S deg F 4B = S deg C 4C = R deg F 4D = R deg C RTD 50 = 4 wire DIN deg F 51 = 4 wire DIN deg C 52 = 4 wire ANSI deg F 53 = 4 wire ANSI deg C 54 = 3 wire DIN deg F 55 = 3 wire DIN deg C 56 = 3 wire ANSI deg F 57 = 3 wire ANSI deg C 58 = 2 wire DIN deg F 59 = 2 wire DIN deg C 5A = 2 wire ANSI deg F 5B = 2 wire ANSI deg C 5C = Short DC Volts 60 = 0.2 V DC 61 = 2 V DC 62 = 20 V DC 63 = 200 V DC 64 = 660 V DC DC Amps 70 = 2 mA DC 71 = 20 mA DC 72 = 200 mA DC 73 = 5 A DC AC Volts 80 = 0.2 V AC 81 = 2 V AC 82 = 20 V AC 83 = 200 V AC 84 = 660 V AC AC Amps 90 = 2 mA AC 91 = 20 mA AC 92 = 200 mA AC 93 = 5 A AC Load Cell C0 = 20 mV DC C1 = 50 mV DC C2 = 100 mV DC C3 = 250 mV DC C4 = 500 mV DC DC mV D0 = 20 mV DC D1 = 50 mV DC D2 = 100 mV DC D3 = 250 mV DC D4 = 500 mV DC

2C	Alarm Cnfg	Bit 7 6 5 4 3 2 1 0	Alarm Trigger Delay
			60 Hz 50Hz
		0 0 0	.018s .021s
		0 0 1	.035 .043
		0 1 0	.07 .085
		0 1 1	.14 .17
		1 0 0	.28 .34
		1 0 1	.56 .68
		1 1 0	1.13 1.36
		1 1 1	2.27 2.72
		0 0 0 0	AL1 Band Dev, AL2 Band Dev
		0 0 0 1	AL1 Hysteres, AL2 Band Dev
		0 0 1 0	AL1 Band Dev, AL2 Hysteresys
		0 0 1 1	AL1 Hysteresys, AL2 Hysteresys
		0 1 0 0	No deviatn in menu or calc
2B	Alarm Cnfg	Bit 7 6 5 4 3 2 1 0	
		0 0 0 0	AL1 hi activ, AL2 hi activ
		0 0 0 1	AL1 lo activ, AL2 hi activ
		0 0 1 0	AL1 disabled, AL2 hi activ
		0 1 0 0	AL1 hi activ, AL2 lo activ
		0 1 0 1	AL1 lo activ, AL2 lo activ
		0 1 1 0	AL1 disabled, AL2 lo activ
		1 0 0 0	AL1 hi activ, AL2 disabled
		1 0 0 1	AL1 lo activ, AL2 disabled
		1 0 1 0	AL1 disabled, AL2 disabled
		0 0	AL1 non-latch, AL2 non-latch
		0 1	AL1 latch, AL2 non-latch
		1 0	AL1 non-latch, AL2 latch
		1 1	AL1 latch, AL2 latch
		0 0	Relay 1 ON, Relay 2 ON
		0 1	Relay 1 OFF, Relay 2 ON
		1 0	Relay 1 ON, Relay 2 OFF
		1 1	Relay 1 OFF, Relay 2 OFF

3-BYTE RAM MEMORY DATA

All items except Scale Factor use this format:

Note: Hex value (2's complement)	MS byte	Mid byte	LS byte
	X X	X X	X X

Scale factor uses this format:			MS byte	Mid byte	LS byte
MS Bit (0 = Polarity and Decimal Point)			0 X	X X	X X
	Positive 1	Negative 9		Decimal point	XXXXX**.**
	2	A		Decimal point	XXXX**.**X
	3	B		Decimal point	XXX**.**XX
	4	C		Decimal point	XX**.**XXX
	5	D		Decimal point	X**.**XXXX
Note: Hex value (Absolute value)	6	E		Decimal point	**.**XXXXX

Hex Addresses

MS	Mid	LS	
A1	A0	9F	Analog high value
9E	9D	9C	Analog low value
9B	9A	99	Deviation Alarm2
98	97	96	Deviation Alarm1
8F	8E	8D	Offset value
8C	8B	8A	Scale factor
89	88	87	Setpoint 2
86	85	84	Setpoint 1

NON-VOLATILE MEMORY ADDRESSES (2 bytes/address)

See the corresponding items above for data significance.

Address	Most Significant Byte	Least Significant Byte
18	Deviation2 3	Deviation2 2
17	Deviation2 1	Deviation1 3
16	Deviation1 2	Deviation1 1
15	Configuration	SC Type (Do not change)
14	Analog Setup	System Decimal Point
13	Lockout 2	Lockout 1
12	Serial Cnfg 2	Serial Cnfg 1
11	Options	Filter
10	Setup	Input Type
0F	Alarm Cnfg 2	Alarm Cnfg 1
0E	Analog High 3	Analog High 2
0D	Analog High 1	Analog Low 3
0C	Analog Low 2	Analog Low 1
0B	High Reading 3	High Reading 2
0A	High Reading 1	High Input 3
09	High Input 2	High Input 1
08	Low Reading 3	Low Reading 2
07	Low Reading 1	Low Input 3
06	Low Input 2	Low Input 1
05	Offset 3	Offset 2
04	Offset 1	Scale Factor 3
03	Scale Factor 2	Scale Factor 1
02	Setpoint2 3	Setpoint2 2
01	Setpoint2 1	Setpoint1 3
00	Setpoint1 2	Setpoint1 1

6.2 COUNTER

1-BYTE RAM DATA TABLE

Hex Address	Name	Bit Assignment
43	Resolutn	Bit 7 6 5 4 3 2 1 0 0 0.00001 multiplier 1 0.0001 multiplier 1 0 0.001 multiplier 1 1 0.01 multiplier 1 0 0 0.1 1 0 1 1 1 1 0 10 1 1 1 100 1 0 0 0 1000 1 0 0 1 10000 1 0 1 0 100000
42	Recogchr	Ascii Value of custom Recognition Character
41	Slope	Bit 7 6 5 4 3 2 1 0 bit = 0 is positive slope 1 = negative slope Channel B 1 = negative slope Channel A
3E	Scalemul	Bits 3-0 = 0-A SCALE1 multiplier Bits 7-4 = 0-A SCALE2 multiplier 0-A Same as Resolutn above
3D	Anaset	Bit 7 6 5 4 3 2 1 0 Analog Output Source 0 0 Filtered Item 0 1 Item 1 1 0 Item 2 1 1 Item 3 1 Analog voltage out (0 = current out)
3C	Source	Bit 7 6 5 4 3 2 1 0 Compare Setpoint 2 to 0 0 Filtered Item 0 1 Item 1 1 0 Item 2 1 1 Item 3 Compare Setpoint 1 to 0 0 Filtered Item 0 1 Item 1 1 0 Item 2 1 1 Item 3

36	Lockout2	Bit 7 6 5 4 3 2 1 0 Bit=0 is unlocked for all items 1 Change Item # locked 1 CALib locked 1 Ser 1, Ser 2, Ser 3 locked 1 An Lo, An Hi, An SEt locked 1 Front Panel meter reset locked 1 Front Panel Peak, Latched resets locked 1 View alarm setpoints locked 1 View Peak locked
35	Lockout	Bit 7 6 5 4 3 2 1 0 Bit=0 is unlocked for all items 1 FiLtEr locked 1 Gate t, ti out, batch, pulses locked 1 SEtuP, ConFiG locked 1 InPut locked 1 Change Setpoints locked 1 SourcE,AL SEt,dEVn1b,1H,2b,2H locked 1 SCALE,OFFSEt,Coords,rESoLn locked 1 SLOPE,dECPt locked
34	Config	Bit 7 6 5 4 3 2 1 0 0 Sample time total zero cutoff 1 Sample ti total allow negative 0 Linear input 1 Square Root of input 0 0 Basic Counter 0 1 Extended Counter 1 0 Extended Counter, Custom curve #1 1 1 Extended Cnr, Custom curve #2 (VF)
	Display mode	0 0 0 0 Normal, Exponential Overload 0 0 0 1 Normal, 999999 Flashing Overload 0 0 1 0 1 Right-Hand dummy zero 0 0 1 1 2 Right-Hand dummy zeros 0 1 0 0 Clock Time, Stopwatch, Multi-format 0 1 0 1 Clock Time, Stopwatch, hhmmss 0 1 1 0 Remote Display, Addressable 0 1 1 1 Remote Display, Single Value 1 0 0 0 Slave Display, 1st data value of string 1 0 0 1 Slave Display, 2nd data value of string 1 0 1 0 Slave Display, 3rd data value of string 1 0 1 1 Slave Display, 4th data value of string
33	SerCnf3	Bit 7 6 5 4 3 2 1 0 Transmit 0 0 0 All active items 0 0 1 Item #1 only 0 1 0 Item #2 only 0 1 1 Item #3 only

33	SerCnf3 (Cont'd)	Bit 7 6 5 4 3 2 1 0 Transmit 1 0 0 Peak value only 1 0 1 All active items + Peak 0 Termination chars end of all items only 1 Termination chars end of each item 1 Latching RTS (0=Non-Latching RTS) 1 Custom recognition character (0 = "*" recog char) 1 Half Duplex (0 = Full Duplex)
32	SerCnf2	Bit 7 6 5 4 3 2 1 0 X X X X X Counter address 0-31 (5 bits) 1 Command Mode (0 = Continuous) 1 Alarm data included with reading (0 = excluded) 1 LF following CR (0=no LF)
31	SerCnf1	Bit 7 6 5 4 3 2 1 0 Continuous output data rate 0 0 0 0 Reading rate 0 0 0 1 Reading rate / 2 0 0 1 0 Reading rate / 4 0 0 1 1 Reading rate / 8 0 1 0 0 Reading rate /16 0 1 0 1 Reading rate /32 0 1 1 0 Reading rate /64 0 1 1 1 Reading rate /128 1 0 0 0 Reading rate /256
	Baud rate	0 0 0 300 baud 0 0 1 600 baud 0 1 0 1200 baud 0 1 1 2400 baud 1 0 0 4800 baud 1 0 1 9600 baud 1 1 0 19200 baud 1 Send filtered value (0 = Send unfiltered value)
30	Options	Do not use.This byte determined by option boards installed
2F	Filter	Bit 7 6 5 4 3 2 1 0 Approximate time constant 0 0 0 No filtering 0 0 1 0.1 sec 0 1 0 0.2 sec 0 1 1 0.4 sec 1 0 0 0.8 sec 1 0 1 1.6 sec 1 1 0 3.2 sec 1 1 1 6.4 sec 1 High adaptive threshold(0=Low threshold) 1 Display filtered input(0=Display unfiltered) 1 Peak val of filtered input(0=Unfiltered input) 1 Conventional filter (0=Adaptive filter)

2E Setup

Bit 3	2	1	0	EXTIN A	EXTIN B
0	0	0	0	Meter Reset	Function Reset
0	0	0	1	Meter Reset	Hold
0	0	1	0	Meter Reset	Peak Display
0	0	1	1	Meter Reset	External Gate
0	1	0	0	Function Rst	Hold
0	1	0	1	Function Rst	Peak Display
0	1	1	0	Function Rst	External Gate
0	1	1	1	Hold	Peak Display
1	0	0	0	Hold	External Gate
1	0	0	1	Peak Display	External Gate
1	0	1	0	Meter Rst	Display Blank
1	0	1	1	Function Rst	Display Blank
1	1	0	0	Hold	Display Blank
1	1	0	1	Peak Display	Display Blank
1	1	1	0	Display Blank	External Gate
1	1	1	1	Display item#2	Display item#3

Bit 4: 0 = Scale2, Offset2 entered directly; 1 = Scale2, Offset2 using Coords of 2 pts

Bit 2: 0 = Scale1, Offset1 entered directly; 1 = Scale1, Offset1 using Coords of 2 pts

Bit 1: 1 = Display leading zeros (0 = Blank leading zeros)

Bit 0: 1 = Restore total with power-on (0 = zero total power-on)

2B Input Type

Dual Signal Conditioner

Rate		Period		Total		Ti Int	
00	A,B	10	A,B	20	A,B	41	A to B
01	A only	11	A only	21	A only		
02	Batch	1B	A+b	24	A-B UpDown	Stopwatch	
03	A,Atot	1C	A-B	26	Burst	50	A to A
05	A,Btot	1D	AXB	27	B,Arate	51	A to B
0B	A+B	1E	A/B	29	A,Bup/down		
0C	A-B			2A	A,Binhibit		Phase
0D	AXB			2B	A+B	61	A to B
0E	A/B			2C	A-B		
0F	A/B-1			2D	AXB		
				2E	A/B		

VF Converter

4-20 mA		0-1 mA		0-10V	
81	A only	91	A only	A1	A only
82	Batch	92	Batch	A2	Batch
83	A,Atot	93	A,Atot	A3	A,Atot
88	Atot,A	98	Atot,A	A8	Atot,A
8F	1/A	9F	1/A	AF	1/A

Quadrature

C0	Total

2C	Alcnf2	Bit 7 6 5 4 3 2 1 0 #Consecutive readings to Alarm 0 0 0 1 0 0 1 2 0 1 0 4 0 1 1 8 1 0 0 16 1 0 1 32 1 1 0 64 1 1 1 128 1 Alarm 1 Hysteresis (0 = Band deviation) 1 Alarm 2 Hysteresis (0 = Band deviation)
2B	Alcnf1	Bit 7 6 5 4 3 2 1 0 0 0 Alarm 1 High Active 0 1 Alarm 1 Low Active 1 0 Alarm 1 Disabled 0 0 Alarm 2 High Active 0 1 Alarm 2 Low Active 1 0 Alarm 2 Disabled 1 Alarm 1 Latching (0 = Non-Latching) 1 Alarm 2 Latching (0 = Non-Latching) 1 Relay 1 Off when Alarm 1 active (0 = On) 1 Relay 2 Off when Alarm 2 active (0 = On)

2-BYTE RAM DATA TABLE

Hex Address		Name	Hex Range	Dec Range
MS	LS			
40	3F	Pulses	0000 - EA5F	0 - 59999 Positive magnitude (Units = 1)
3A	39	Timeout	0000 - 4E1F	0 - 19999 Positive magnitude (Units = .01sec)
38	37	Gatetime	0000 - 4E1F	0 - 19999 Positive magnitude (Units = .01sec)

3-BYTE RAM DATA TABLE

VALUES STORED AS 3-BYTE 2'S COMPLEMENT

Hex Address			Name	Hex Address			Name
MS	mid	LS		MS	mid	LS	
B0	AF	AE	Deviation2 (Hysteresis2)	AD	AC	AB	Deviation1 Values always + (Hysteresis1)
AA	A9	A8	Offset2	A4	A3	A2	Offset1
9E	9D	9C	Setpoint2	9B	9A	99	Setpoint1

VALUES STORED AS SIGN (MS BIT) + MAGNITUDE (ALL OTHER BITS) FIXED DP=6

Hex Address			Name	Hex Address			Name
MS	mid	LS		MS	mid	LS	
A7	A6	A5	Scale2	A1	A0	9F	Scale1

NON-VOLATILE MEMORY ADDRESSES (2 bytes/address)

Sign + Magnitude	XXXX XXXX XXXX XXXX XXXX XXXX S Magnitude	S=Sign Sign = 1 for negative
Sign+DP+Magnitude	XXXX XXXX XXXX XXXX XXXX XXXX S DP Magnitude	DP = 1 = DDDDDD. DP = 6 = D.DDDDD

* These values are used only during Reset and are not available in RAM.

Address	Most Significant Byte	Least Significant Byte	Stored As
1A *	Analog High 3	Analog High 2	2's Complement
19 *	Analog High 1	Analog Low 3	2's Complement
18 *	Analog Low 2	Analog Low 1	2's Complement
17	Deviation2 3	Deviation2 2	Pos Magnitude
16	Deviation2 1	Deviation1 3	Pos Magnitude
15	Deviation1 2	Deviation1 1	Pos Magnitude
14	Offset2 3	Offset2 2	2's Complement
13	Offset2 1	Scale2 3	2's CPL / S+M
12	Scale2 2	Scale2 1	Sign + Magnitude
11	Offset1 3	Offset1 2	2's Complement
10	Offset1 1	Scale1 3	2's CPL / S+M
0F	Scale1 2	Scale1 1	Sign + Magnitude
0E	Setpoint2 3	Setpoint2 2	2's Complement
0D	Setpoint2 1	Setpoint1 3	2's Complement
0C	Setpoint1 2	Setpoint1 1	2's Complement
0B *	High Reading2 3	High Reading2 2	2's Complement
0A *	High Reading2 1	High Input2 3	2's CPL / S+DP+M
09 *	High Input2 2	High Input2 1	Sign+DP+Magnitude
08 *	Low Reading2 3	Low Reading2 2	2's Complement
07 *	Low Reading2 1	Low Input2 3	2's CPL / S+DP+M
06 *	Low Input2 2	Low Input2 1	Sign+DP+Magnitude
05 *	High Reading1 3	High Reading1 2	2's Complement
04 *	High Reading1 1	High Input1 3	2's CPL / S+DP+M
03 *	High Input1 2	High Input1 1	Sign+DP+Magnitude
02 *	Low Reading1 3	Low Reading1 2	2's Complement
01 *	Low Reading1 1	Low Input1 3	2's CPL / S+DP+M
00 *	Low Input1 2	Low Input1 1	Sign+DP+Magnitude

7.0 SOURCE LISTING

The following are some of the available sources for cables, connectors, and boards to be used with RS-232 and RS-485 serial communications. Prices shown may not be the most current.

1. QUA TECH 666 Wolf Ledges Parkway, Akron, OH 44311 1-800-553-1170

   Products: RS-232, RS-485 and other serial communications boards.
   DS-225/DS-325 RS-232, RS-422/RS-485, Current Loop multi-functional communications board for the IBM PC. $245.00

2. PERSONAL COMPUTING TOOLS 17419 Farley Rd. West, Los Gatos, CA 95030 1-800-767-6728
Products: IBM PC Data Acquisition and control, RS-232, RS-485 and other serial communications.
IC-11/F RS-232 to RS-485 Converter that plugs into a standard RS-232 port on the computer and converts the data to RS-485. It is an inexpensive means of using RS-485 serial communications with the meters $89.00

3. SEALEVEL SYSTEMS INCORPORATED
PO Box 1808, Easley, SC, 29641 (803) 855-1581
Products: RS-232, RS-422, RS-485 boards for the IBM PC

4. L-COM 1755 Osgood St., Rte 125, North Andover, MA 01845 (508) 682-6936
FAX (508) 689-9484 Orders only 1-800-343-1455
Products: Serial communication cables, connectors, switch boxes
RA096F - 9-pin Subminiature D to Modular plug with programmable wiring. $6.45
RA256F - 25-pin Subminiature D to Modular adapter with programmable wiring. $7.45

4 Conductor cables for RS-232

Flat modular cable STRAIGHT-THRU PINNING			Round modular cable CROSS-PINNED		
TDC301	1 foot	$ .95	TRC403-7	7 feet	$1.75
TDC302	2 “	1.05	TRC403-14	14 “	2.45
TDC303	3 “	1.15	TRC403-25	25 “	3.55
TDC305	5 “	1.35			
TDC307	7 “	1.55			
TDC314	14 “	2.25			
TDC325	25 “	3.35			

6 Conductor cables for RS-485

Flat modular cable STRAIGHT-THRU PINNING			Flat modular cable CROSS-PINNED		
TDC057-7	7 feet	$2.55	TDC027-7	7 feet	$2.55
TDC057-14	14 “	3.80	TDC027-14	14 “	3.80
TDC057-25	25 “	5.55	TDC027-25	25 “	5.55

TDS1039-6C TEE Adaptor - accepts 3 modular 4 or 6 pin plugs $2.75

5. BLACK BOX CORP PO Box 12800, Pittsburgh, PA 15241 (412) 746-5530
Products: 4 and 6 wire modular cables, STRAIGHT-THRU and CROSS-PINNED RS-232 to RS-485 converters

6. DIGI-KEY CORP
701 Brooks Ave. South PO Box 677 Thief River Falls, MN 56701-0677
1-800-344-4539
Products: Modular cables, Subminiature D to Modular adapters