THE LAUREATE SERIES

Serial Comunications Manual

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CONTENTS

1.0 HARDWARE AND SOFTWARE SETUP

The word “modular” 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. An 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 RS485 converter in the computer.

To connect 2 or more meters to a computer you will need as a minimum:
1. The same two items as above.
2. One STRAIGHT-THRU modular extension cable for each meter.

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.

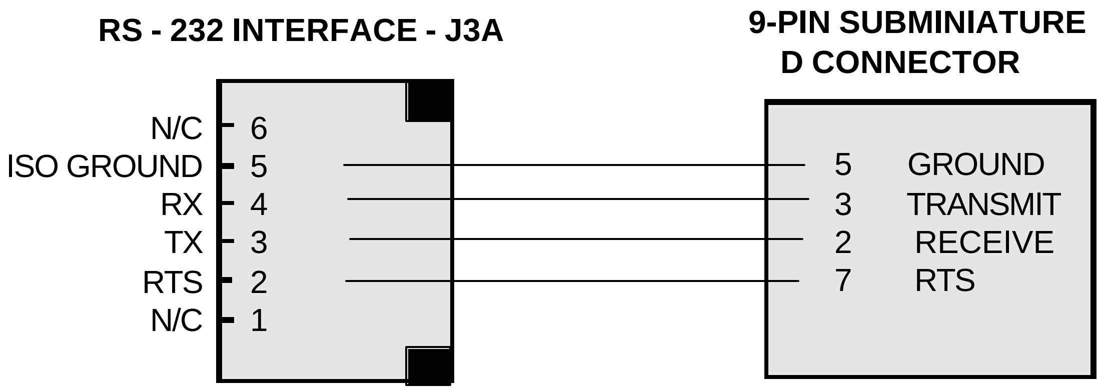
CAUTION: There are two common types of modular extension cables, those wired STRAIGHT-THRU for data applications and those wired in REVERSE or CROSS-PINNED for telephone extensions.

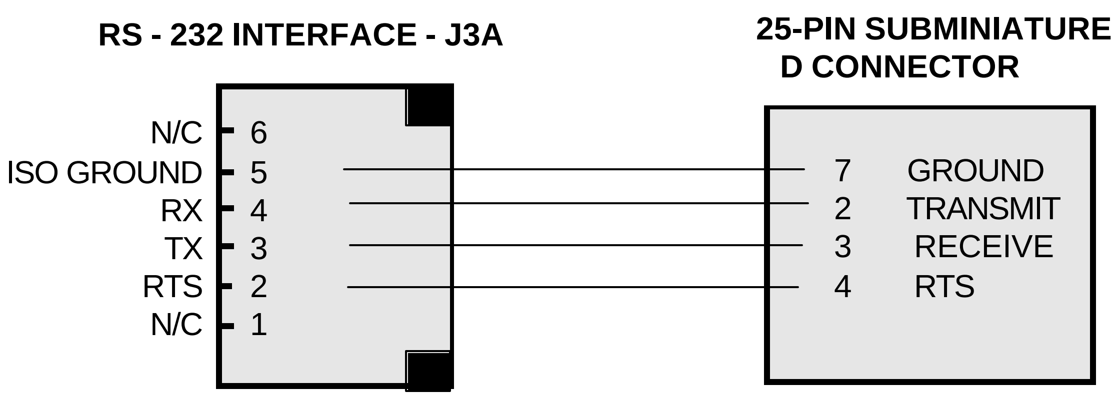
1.1 SELECTING THE MODULAR CABLE TYPE.

Application	Cable Type
Computer to single meter	Use a STRAIGHT-THRU modular cable and then wire the modular-to- subminiature D connector adapter that plugs into the computer.
Computer to multiple meters (multi-drop)	Use a STRAIGHT-THRU modular cable and then wire the modular-to- subminiature D connector adapter that plugs into the computer and STRAIGHT-THRU modular cables for all remaining connections.
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 meter and STRAIGHT-THRU modular cables for all remaining connections.

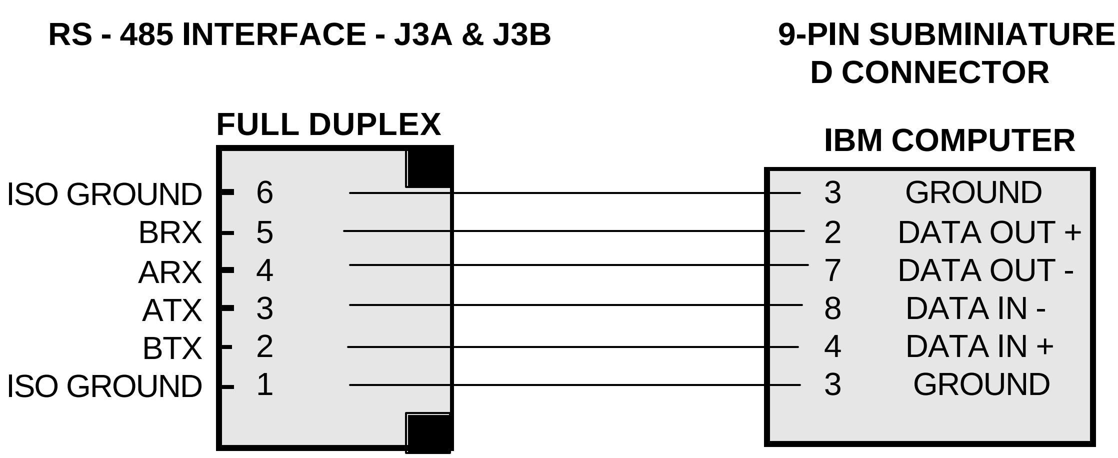
1.2 RS232 AND RS485 WIRING CONNECTIONS

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



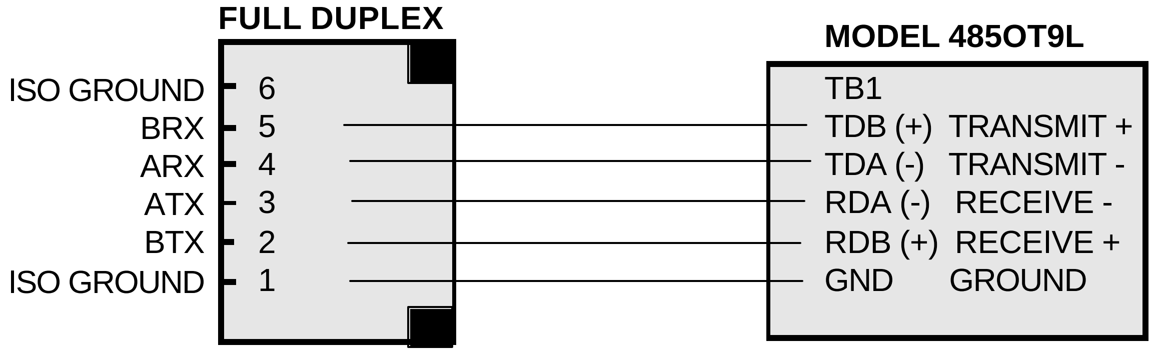


Note: The IBM computer normally has male RS-232 connectors so the modular adapter should have a female connector.



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 B & B Electronics Model 485OT9L.

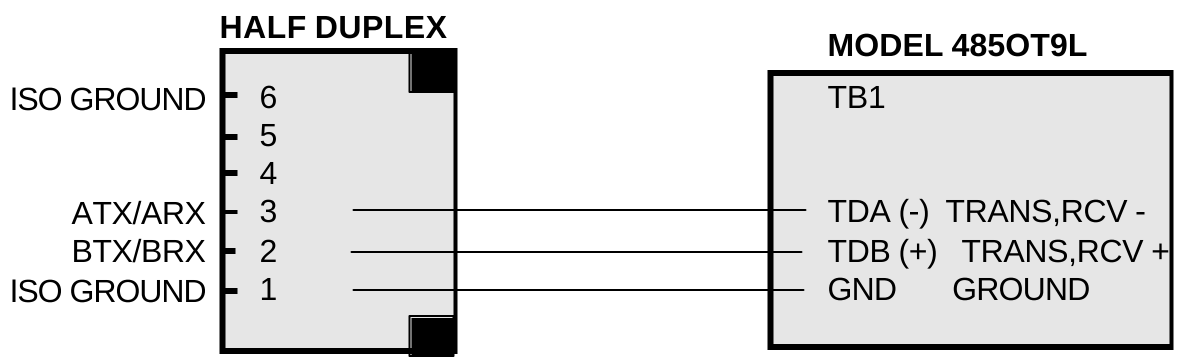
RS - 485 INTERFACE - J3A & J3B **RS232 TO 485 CONVERTER**



SWITCH SETTINGS FOR MODEL 485OT9L

Baud rate					
4800 Baud	-	S1-ON,	S2-OFF	S3-OFF	S4-OFF
9600 Baud	-	S1-0FF,	S2-ON	S3-OFF	S4-OFF
19200 Baud	-	S1-OFF,	S2-OFF	S3-ON	S4-OFF
Echo	-	S5-OFF			
2-wire/4-wire	-	S6-OFF,	S7-OFF		
Termination	-	S8-OFF			
Driver Control	-	JP1-Jumper on SD			

RS - 485 INTERFACE - J3A & J3B **RS232 TO 485 CONVERTER**

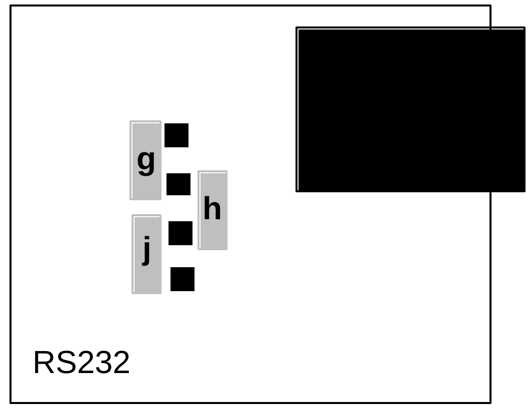


SWITCH SETTINGS FOR MODEL 485OT9L

Baud rate					
4800 Baud	-	S1-ON,	S2-OFF	S3-OFF	S4-OFF
9600 Baud	-	S1-0FF,	S2-ON	S3-OFF	S4-OFF
19200 Baud	-	S1-OFF,	S2-OFF	S3-ON	S4-OFF
Echo	-	S5-ON			
2-wire/4-wire	-	S6-ON,	S7-ON		
Termination	-	S8-OFF			
Driver Control	-	JP1-Jumper on SD			

1.3 RS-232 AND RS-485 JUMPERS SETTINGS

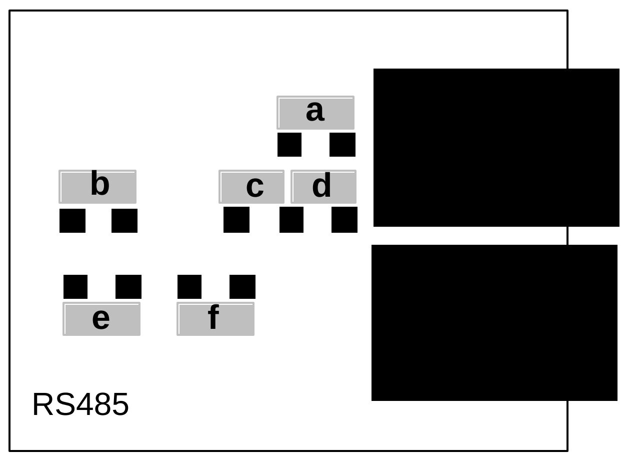
RS232 Interface



Jumper g - installed for normal operation
Jumper h - installed when used as a slave display with the RS232 output of another meter of the series.
Jumper j - provides a pull-up resistor on the RTS line.

Note: The board is shipped standard with jumpers **g** and **j** installed

RS485 Interface



Note: Bias jumpers b and e must be installed on board for proper operation. If the outputs of more than 1 RS485 are connected together, then one (*<u>AND ONLY ONE</u>*) RS485 board must have the jumpers installed.

Full Duplex

Jumpers b and **e** - bias jumpers installed on one board
Jumpers a and d - are installed with long cable runs to add 121 ohm termination resistors. If multiple meters are on same line, only the last meter in the line should be jumpered.

Half Duplex

Jumpers b and **e** - bias jumpers installed on one board
Jumpers c and **f** - installed for half duplex operation
Jumper a - is installed with long cable runs to add 121 ohm termination resistor. If multiple meters are on same line, only the last meter in the line should be jumpered.

1.4 SERIAL INTERFACE SETUP - ALL METERS

MENU KEY ⮕	DIGIT SELECT KEY ▶	VALUE SELECT KEY ▲
Ser 1 Serial interface setup (only enabled if communications board installed)	**0**00 Output filtering	**0** Send unfiltered signal **1** Send filtered signal
	0**0**0 Baud rate	**0** 300 baud **1** 600 baud **2** 1200 baud **3** 2400 baud **4** 4800 baud **5** 9600 baud **6** 19200 baud
	00**0** Digital output rate rr = reading rate (rate dependent on gate time and input frequency)	**0** Output at reading rate **1** Output at rr/2 **2** Output at rr/4 **3** Output at rr/8 **4** Output at rr/16 **5** Output at rr/32 **6** Output at rr/64 **7** Output at rr/128 **8** Output at rr/256
Ser 2 Serial interface setup (only enabled if communications board installed)	**0**000 Line Feed	**0** None after carriage rtn **1** LF after carriage return
	0**0**00 Alarm data transmitted with meter readings	**0** No alarm data **1** Alarm data with reading
	00**0**0 Control of digital output	**0** Continuous output **1** Output on RS-232 / RS-485 command only
	000**0** Meter address for RS-232/ RS-485 communication	Addresses 1 thru 15 are denoted by 1 thru 9 and A thru F. Addresses 16 thru 31 use the same character followed by a decimal point

1.5 SERIAL INTERFACE SETUP - COUNTER ONLY

MENU KEY ➡	DIGIT SELECT KEY ▶	VALUE SELECT KEY ▲
Ser 3 Serial interface setup (only enabled if communications board installed)	00000 RS485 full or half duplex	0 Full duplex 1 Half duplex
	00000 Meter recognition character and start & stop character	0 " * " , none, CR 1 Spl, none, CR 2 " * " , Spl, Spl 3 Spl , Spl, Spl
	00000 RS232 RTS type	0 Nonlatching RTS 1 Latching RTS
	00000 Carriage return (and LF)	0 Only at end of all items 1 At end of each item
	00000 Data sent via communications (if BCD, only 1 item allowed)	0 All active items sent 1 Item #1 only 2 Item #2 only (if active) 3 Item #3 only (if active) 4 Peak value 5 All active items + peak

1.6 SERIAL INTERFACE SETUP - SCALE METER ONLY

Ser 3 Serial interface setup (only enabled if communications board installed)	00000 RS485 full or half duplex	0 Full duplex 1 Half duplex
	00000 Special start &stop character	0 Normal format, continuous 1 Special start and stop
	00000 RS232 RTS type	0 Nonlatching RTS 1 Latching RTS
	00000 Carriage return (and LF, if selected)	0 Only at end of all items 1 At end of each item (If alarm, only at end)
	00000 Data sent via communications (if BCD, only 1 item allowed)	0 Net and Gross 1 Net only 2 Gross only 3 Peak only (net or gross) 4 Net & gross & peak

2.0 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.

3.0 RS232 AND RS485 FORMAT

3.1 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

3.2 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>. The line feed may be selected in "Ser 2"

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 may be selected in "Ser 2"

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 and Scale meter are capable of supplying more than 1 measurement value each reading. In the counter, depending on the selected Function, there can be 1,2 or 3 active measurement values plus a peak value. The scale meter can transmit net, gross and peak. The values transmitted are selected by "Ser 3"

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.

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. For long cable runs, the last meter should have the termination resistors installed. 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 set in “Ser 2”,
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.

5.0 OPERATING 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 and Scale meter only

The transmission rate of measurement data can be selected in “Ser 1”. The meter conversion rate equals 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.

Output rate	Data Output Rate	Minimum Baud rate		
Ser 1 setting	50 Hz / 60 Hz	1 Item sent	2 Items sent	3 Items sent
0	.021s / .018 s	9600	9600	19200
1	.34 s / .28 s	600	600 / 1200	1200
2	.68 s /.57 s	300	300 /600	600
3	1.4 s / 1.1 s	300	300	300
4	2.7 s / 2.3 s	300	300	300
5	5.4 s / 4.5 s	300	300	300
6	1.9 s / 9.1 s	300	300	300
7	21.8 s / 18.1 s	300	300	300
8	43.5 s / 36.3 s	300	300	300
9	86.7s / 72.3 s	300	300	300

Counter only

The transmission rate of measurement data can be selected in “Ser 1". 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
19200	.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. This selection is made in “Ser 1” .

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 meters have 2 modes for RTS control, unlatched and latched. In the unlatched mode, 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 in "config" "digit 2" in the DPM and in the Counter and Scale meter by “Ser 3” .

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 by the receipt of an ASCII XOFFcharacter.

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",

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 FORMAT

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

CHAR 1 - COMMAND IDENTIFIER

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). The counter may be assigned a different recognition character via the RS232/485 serial port but will still recognize the "∗"

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 character that is set in menu item "SER 2",

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> (followed by an optional <lf>.

COMMUNICATIONS MODE

Continuous mode	∗1A0
Command mode	∗1A1

.

REQUEST DPM/SCALE VALUE

Latest reading	∗1B1 *
Peak value	∗1B2

* - The scale meter transmits the value or values selected in Ser 3

REQUEST COUNTER VALUES

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

RESET FUNCTIONS -DPM AND SCALE METER

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	

5.3 READ AND WRITE TO RAM AND NONVOLATILE MEMORY

CHARACTER 1 AND 2

The Recognition character and Meter Address Code is the same as address codes shown in previous table

CHARACTER 3

Command character

G	Read bytes from RAM Memory
F	Write bytes to RAM Memory (DPM and Scale meter only)
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 NONVOLATILE 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
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 code 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 NONVOLATILE MEMORY DATA

Nonvolatile 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 nonvolatile memory of the continuous string of words. The format is:

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

aa is the most significant address in nonvolatile 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 coded 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 under NON-VOLATILE MEMORY ADDRESSES.

5.4 REMOTE DISPLAY COMMAND FORMAT

5.4.1. 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 3.2.

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 occurrences:

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.

5.4.2. COUNTER

The Counter has 13 Display Modes (0-12). Modes 0-5 are normal measurement modes and Modes 6-12 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
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
C	Programmed to select specific data from a data string	1 Value only

The addressable commands of Modes 0-6 can display remote data on one or more Counters having the command address 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 or Scale meter to Slave Counter or 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, (Scale meter transmits up to 3 values) each measurement cycle, Modes 8-11 provide the ability of the Remote Display 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

Mode 12 - Remote display "C"

This mode is used to extract data from an ASCII string that contains more than multiple data values or non-numeric characters. When in Remote Display C mode, it can accommodate selected Start and Stop characters and any number of characters between the Start character and the data can be masked OFF and up to 8 display characters (including sign and DP) can be masked ON and any number of characters between the last displayed character and the Stop character masked OFF.

When CONFIG, CXXX is set, it is a Masked Remote Display and the following parameters determine the operation. They must be set while the meter is set to something other than CONFIG, CXXX however, because that is the one setting for which there is no serial communications with the meter. It is suggested to use CONFIG, 6XXX to set the following parameters and then to use CONFIG, CXXX for operation.

1. START character (set to 00 if none desired)
2. STOP character (set to 00 if none desired)
   Note: Only one of the above can be set to 00.
3. Number of characters following the START character to be ignored
4. Number of characters following the ignored characters to be displayed

Either Instrument Setup.exe or Serial.exe may be used to set the values for Remote Display C mode. These programs may be downloaded from our website.

5.5 RECOGNITION CHARACTER AND START AND STOP CHARACTERS

The meter recognizes an asterisk (*) as the command recognition character. In the counter, another command recognition character may be chosen to make the meter compatible with an existing system. The meter will still respond to an asterisk. For all meters, in continuous mode, a device ,such as a printer, may require a start and stop bit to recognize the data string being sent. Normally there is no start bit and the stop bit is a carriage return <cr>. When the Counter is in a normal operating mode (not Remote Display), SER 3, XDXXX can be set for the following combinations:

D	Command Recognition Char	Continuous Readings Start Char	Continuous Readings Stop Char
0	*	None	CR
1	Selected	None	CR
2	*	Selected	Selected
3	Selected	Selected	Selected

Either Instrument Setup.exe or Serial.exe may be used to set the Command recognition character and the start stop characters. These programs may be downloaded from our website.

6.0 MEMORY ADDRESSES AND DATA DEFINITIONS

6.1 DPM

1-BYTE RAM DATA TABLE

Hex Address	Item Name	Hex Value
E1	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

BF	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	Lockout2	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	Lockout1	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 Cnfg2	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 Cnfg1	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 Cnfg1	Bit 7 6 5 4 3 2 1 0 Continuous Output Data Rate
	(continued)	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)
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
		* Both ExtinA & * 0 1 0 Meter Hold Peak Display
		ExtinB = * 0 1 1 Meter Hold Tare
		Function reset * 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
		0 Normal Format, Ser Com Continuous mode
		1 Special Start & Stop characters
		1 = 50 Hz DPM power (0 = 60 Hz power)
		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

2C	Alarm Cnfg2	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				AL1 Band Dev, AL2 Band Dev	
					0	0	1				AL1 Hysteres, AL2 Band Dev	
					0	1	0				AL1 Band Dev, AL2 Hysteresys	
					0	1	1				AL1 Hysteresys, AL2 Hysteresys	
					1	0	0				No deviatn in menu or calc	
2B	Alarm Cnfg1	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 Nibble *(Polarity and Decimal Point)	* 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)

RAM HEX DATA TABLE

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

NONVOLATILE MEMORY ADDRESSES (2 bytes/address)

See the corresponding itemsin RAM 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	Resolution	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	Recog char	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	Scale multiplier	Bits 3-0 = 0-A SCALE1 multiplier Bits 7-4 = 0-A SCALE2 multiplier 0-A Same as Resolutn above
3D	Analog setup	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

			7	6	5	4	3	2	1	0	
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	Lockout1	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	Configuration	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
		Display mode					1	1			Extended Cnr, Custom curve #2 (VF)
			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
			1	1	0	0					Masked display
33	Serial Cnfg3	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	Serial Cnfg3 (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	Serial Cnfg2	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	Serial Cnfg1	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
			Baud rate				1	0	0	0	Reading rate /256
				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 7	6	5	4	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
			0	Scale2, Offset2 entered directly					
			1	Scale2, Offset2 using Coords of 2 pts					
		0	Scale1, Offset1 entered directly						
		1	Scale1, Offset1 using Coords of 2 pts						
	1	Display leading zeros (0 = Blank leading zeros)							
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

Address	Name	Bit 7	6	5	4	3	2	1	0	Description
2C	Alarm cnfg2									#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	Alarm cnfg1									
								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 MS	Hex Address LS	Name	Hex Range	Dec Range	
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 MS	mid	LS	Name	Hex Address MS	mid	LS	Name
B0	AF	AE	Deviation2 (Hysteresis2)	AD	AC	AB	Deviation1 (Hysteresis1) Values always +
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 MS	mid	LS	Name	Hex Address MS	mid	LS	Name
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

6.3 WEIGHT METER
1-BYTE RAM DATA TABLE

Hex Address	Item Name	Hex Value
6B	Configuration	Bit 7 6 5 4 3 2 1 0 0 = Linear Data 1 =Custom Curve (Extended DPM) 0 = Peak of net value 1 = Peak of gross value 0 = Setpoint off set enabled 1 = Setpoint offset disabled 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
BF	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 = Output of net value 1 = Output of gross value 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	Lockout2	Bit 7 6 5 4 3 2 1 0 bit = 0 is unlocked for all items 1 = SEr 1, Ser 2, Ser3 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	Lockout1	Bit 7 6 5 4 3 2 1 0 bit = 0 is unlocked for all items 1 = Count locked 1 = Setup, config and dEC.Pt locked 1 = Input type locked 1 = Change display item number 1 = Tare Locked 1 = Offset, LO, HI RD locked 1 = View alarm setpoints locked 1 = View peak locked
32	Serial Cnfg2	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 Cnfg1	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 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)
17	Serial Cnfg3	Bit 7 6 5 4 3 2 1 0 Data Sent 0 0 0 .Net and gross 0 0 1 Net only 0 1 0 Gross only 0 1 1 Peak only 1 0 0 Net, gross and peak 0 CR (LF) after all items (1=after each item) 0 Non-latching RTS (1 = Latching RTS) 0 Not used 0 RS 485 full duplex (1 = Half duplex)

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 signa l (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 0 Meter Reset Meter Hold 0 0 0 1 Function Reset Peak Display 0 0 1 0 Meter Hold Peak Display 0 0 1 1 Meter Hold Tare 0 1 0 0 Peak Display Tare 0 1 0 1 Meter reset Tare 0 1 1 0 Function reset Tare 0 1 1 1 Tare reset Tare 1 0 0 0 Display blank Tare 1 0 0 1 Meter reset Display blank 1 0 1 0 Function Reset Display blank 1 0 1 1 Display item Tare 1 1 0 0 Display item Display blank 1 1 0 1 Meter reset Display item 1 1 1 0 Function reset Display item 1 1 1 1 Meter hold Display item 0 Scale using scale and offset 1 Scale using coordinates of two points 0 Peak key displays peak 1 Peak key tares net value 0 No dummy zero 1 Displays dummy zero

2C	Alarm Cnfg2	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
											Alarm comparison	
			0	0	0	0	0				AL1 Net, AL2 Net	
			0	0	0	0	1				AL1 Gross, AL2 Net	
			0	0	0	1	0				AL1 Net, AL2 Gross	
			0	0	0	1	1				AL1 Gross, AL2 Gross	
2B	Alarm Cnfg1	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
E4	E3	E2	Tare value

NON-VOLATILE MEMORY ADDRESSES (2 bytes/address)

See the corresponding items above for data significance.

Address	Most Significant Byte	Least Significant Byte
BD	Tare 3	Tare 2
1C	Tare 1	Spare
1B	Serial Cnfg 3	Count
18	Setpoint2 Diff 3	Setpoint2 Diff 2
17	Setpoint2 Diff 1	Setpoint1 Diff 3
16	Setpoint1 Diff 2	Setpoint1 Diff 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

7.0 SOURCE LISTING

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Website: www.bb-elec.com

B & B manufactures a variety RS485 to RS232 converters and RS232 and RS485 to USB converters. They also have RJ11 to 9 pin adapters .

The Model 485OT9L is the recommended RS485 to RS232 converter.

WARRANTY

Laurel Electronics Inc. warrants its products against defects in materials or workmanship for a period of one year from the date of purchase.

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 Laurel 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.

The warranty set forth above is exclusive and no other warranty, whether written or oral, is expressed or implied. Laurel specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

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The remedies provided herein are Buyer’s sole and exclusive remedies. In no event shall Laurel be liable for direct, indirect, incidental or consequential damages (including loss of profits) whether based on contract, tort, or any other legal theory.