Y800^Plus

Custom ASCII Protocol Serial Communications

INSTRUCTION MANUAL

Now with Ethernet

Intertek
4006497

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2. INTRODUCTION, CUSTOM ASCII SERIAL PROTOCOL

The Custom ASCII Protocol is a simple serial communications protocol which is optimized for use with our programmable digital panel meters, counters, timers and transmitters.

Digital panel meters, counters and timers accept an optional serial communications plug-in board, which can be any of the following:

- RS232 board
- RS485 board with dual RJ11 jacks.
- RS485 board with dual RJ45 jacks
- USB board
- USB-to-RS485 converter board
- Ethernet board
- Ethernet-to-RS485 converter board

Our two RS485 meter boards use the same circuitry and support the same serial protocols. The boards with dual RJ11 jacks can be daisy-chained using readily available, straight-through 6-wire data cables (not 4-wire telephone cables or crossover cables). Dual RJ45 jacks are available for use with Modbus, as recommended in the Modbus Specification. With either board, the two jacks are wired in parallel to allow daisy chaining of meters with no need for a hub. External repeaters can be used to increase the number of addressable meters.

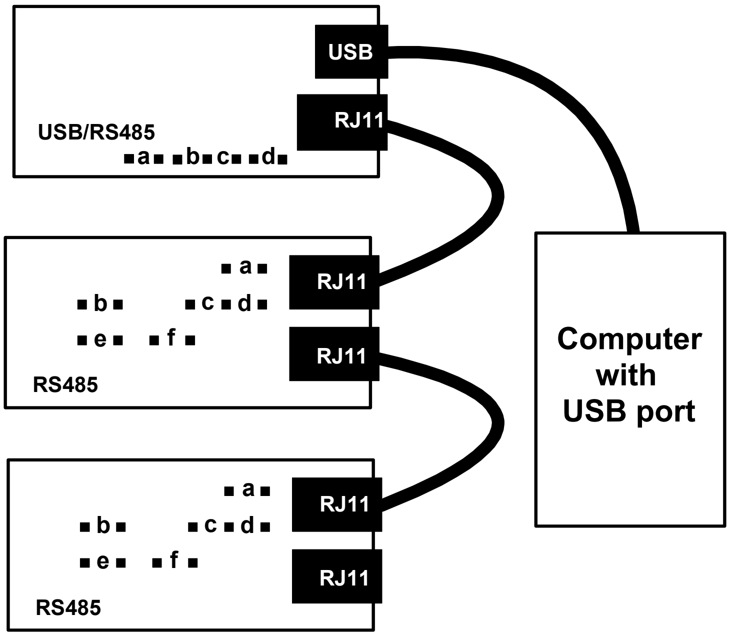
Our USB-to-RS485 and Ethernet-to-RS485 converter boards allow the host meter to function as a normal meter, be connected to a host computer or Ethernet local area network (LAN), and also act as the device server for an RS485 network of up to 31 meters. These should be equipped with RS485 board with RJ11 connectors for daisy chaining with 6-wire data cables.

Our DIN-rail transmitters come with either an Ethernet or RS232/RS485 I/O port as ordered. This is in addition to a scalable 4-20 mA output and dual relays, which are standard.

Our DIN-rail Ethernet-to-RS485 device server provides an RJ45 jack for connection to the Ethernet, an RJ11 jack to support an RS485 network of meters, plus screw terminals to support an RS485 network of DIN-rail transmitters via a set of 3 or 5 parallel wires (half- or full-duplex).

The Modbus Protocol, described in a different manual, is a software-selectable alternative to the Custom ASCII Protocol. It is fully compliant with Modbus over Serial Line Specification V1.0 (2002). It is an industry standard which allows devices by different manufacturers to be digitally addressed on the same network. However, it is more complex than the Custom ASCII Protocol and is only recommended when Modbus compatibility is required. In Ethernet networks, the Modbus TCP protocol is seamlessly converted to Modbus RTU or Modbus ASCII by our Ethernet software. Note: Modbus is not supported by our weight meter.

USB connection of multiple meters to a PC can be via a USB hub or up to 5 hubs in series. Each USB connection is then automatically assigned a virtual com port number, which can be addressed via software. The USB standard specifies the maximum length of a USB cable as 5 meters (16 ft).

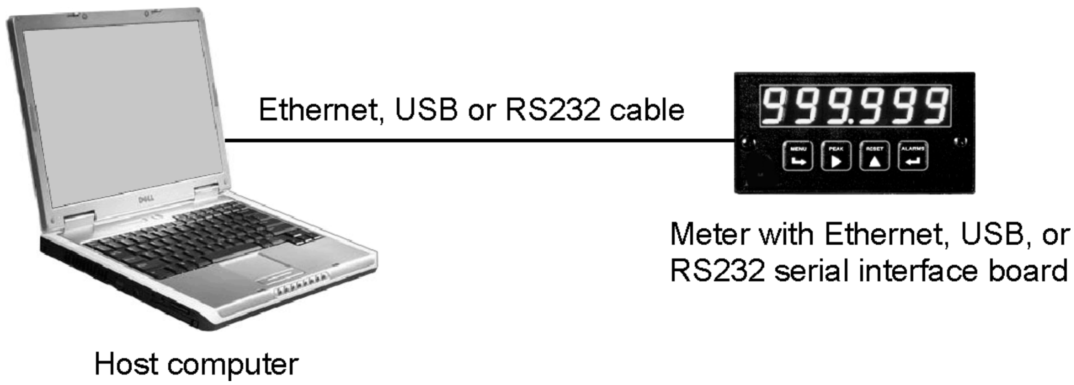


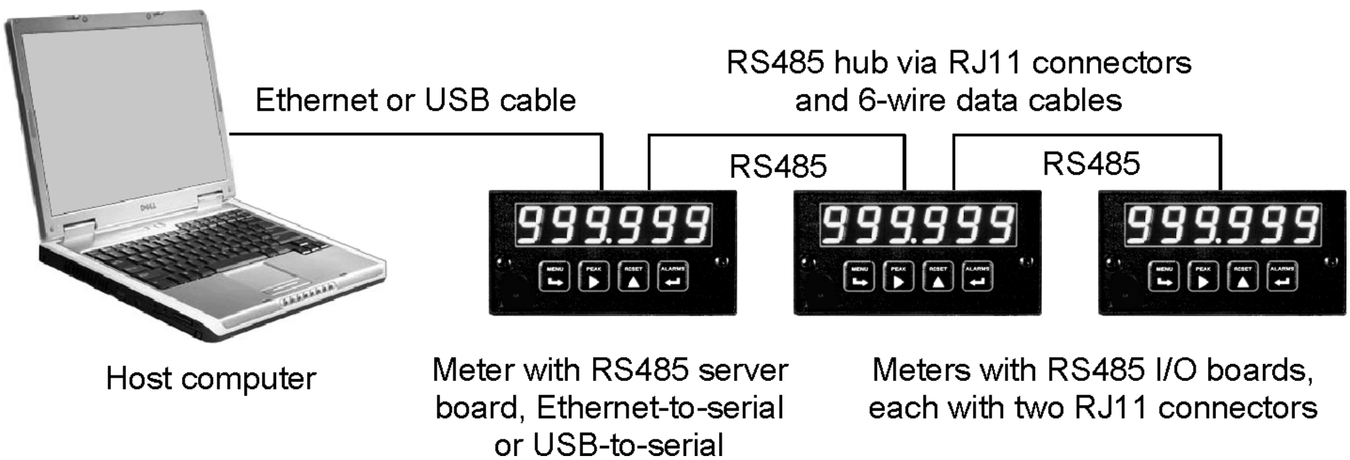
A better way to connect multiple meters to a PC USB port is to install an isolating USB-to-RS485 converter board in the first meter and to daisy chain multiple meters each with an RS485 board. Use a standard USB cable, Male Type A to Male Type B, to connect the PC to the server meter. The RJ11 output of each RS485 meter can then be connected to the next meter via a 6-conductor straight-through data cable. Up to 30 additional meters may be daisy chained and be addressed using the Custom ASCII Protocol.

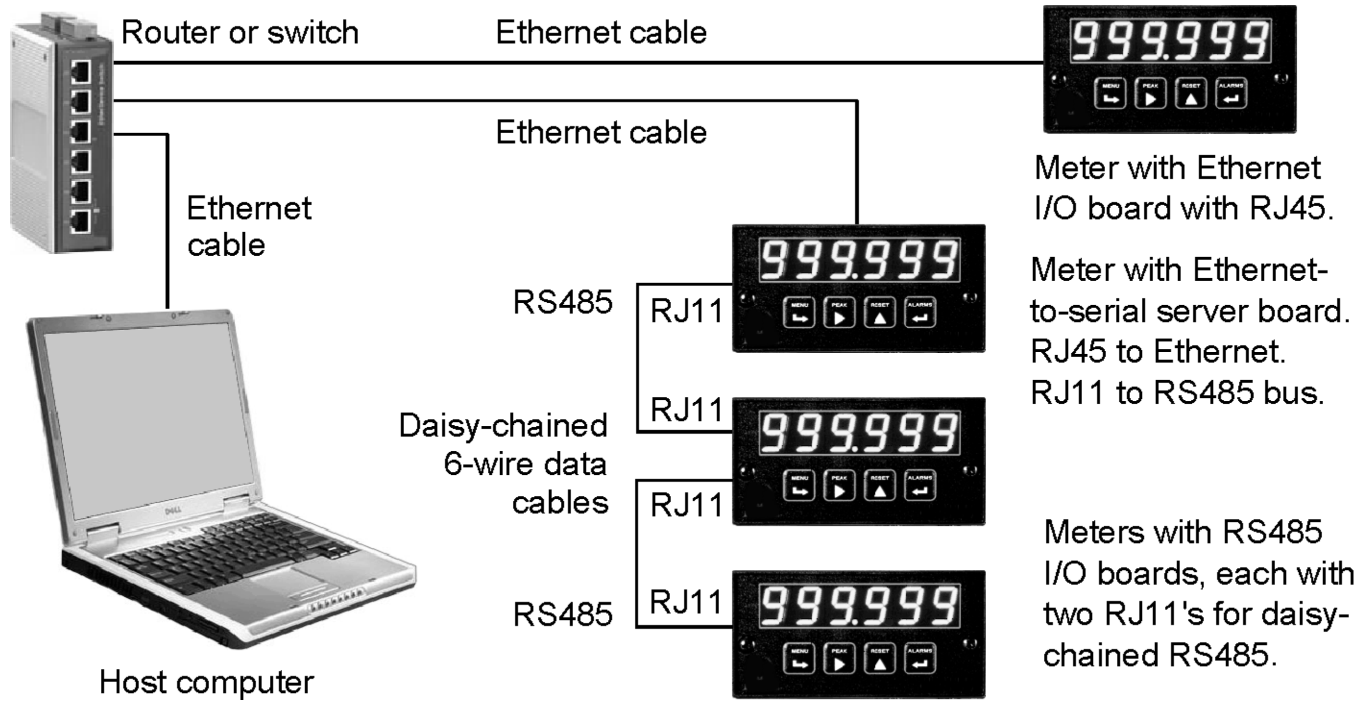
To connect a meter with a USB board to a Windows PC, use a USB cable with Type A and Type B connectors. Upon first connection, your computer may display "Found new Hardware" and automatically download and install the required USB driver from the Internet. If installation is not automatic, download the driver file (with a name like CDM v2.10.00 WHQL Certified.zip) from http://www.ftdichip.com/Drivers/VCP.htm. Unzip it into its own directory, and point to that directory as the location of the driver. You will need to use Device Manager (accessible from Control Panel) to determine the com port. Go down the device list and click on Ports (COM & LPT) and USB serial port (com #). Note the com port # for use with communications to your meter, then exit Control Panel. If you later need to change the Com port, right-click on USB serial port (com #), then on Properties, Port settings, and Advanced. Change port to the desired number, click OK, then exit Control Panel.

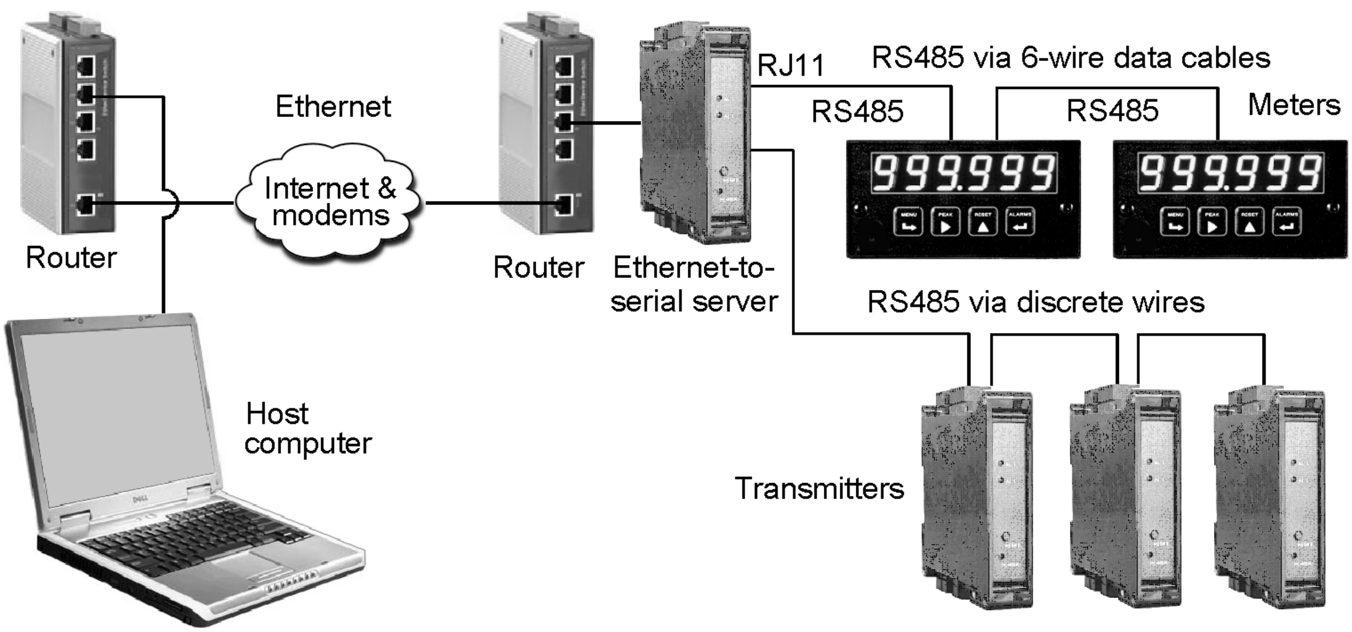
Ethernet connection of meters and transmitters requires device configuration via our Node Manager Software, a Windows-based application that runs on a host computer. Node Manager automatically discovers all Nodes on a LAN or WAN, plus any devices connected to each Server Node via an RS485 bus. It is used to configure each Node, such as setting communication parameters, naming the Node and associated devices, entering email addresses for alarm notification and data requests, selecting the Node's time zone for time-stamping of emails and streaming data, and upgrading firmware. Once configuration data has been stored in flash memory of all Nodes, Node Manager Software can be closed. Please see our separate Ethernet Manual.

3. SERIAL CONNECTION EXAMPLES






Router or switch
Ethernet cable
Ethernet cable
Ethernet cable
Host computer
RS485
RJ11
RJ11
Daisy-chained 6-wire data cables
RJ11
RJ11
RS485
999999
Meter with Ethernet I/O board with RJ45.
Meter with Ethernet-to-serial server board. RJ45 to Ethernet. RJ11 to RS485 bus.
Meters with RS485 I/O boards, each with two RJ11's for daisy-chained RS485.


Router
Ethernet
Internet & modems
Router
Ethernet-to-serial server
RJ11
RS485 via 6-wire data cables
RS485
RS485
Meters
999999
RS485 via discrete wires
Host computer
Transmitters

4. JUMPER SETTINGS & FIELD WIRING

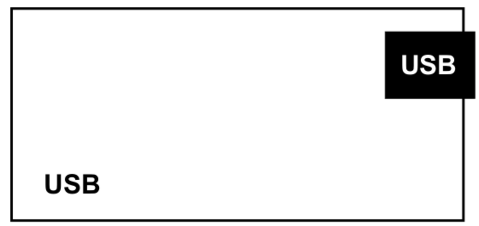
1. SAFETY WARNINGS ⚠

Digital panel meters, counters, timers and transmitters may be powered with AC (mains) from 85-264 Vac or 95-300 Vdc with standard high voltage power, or 12-34V ac or 10-48 Vdc with the low voltage power supply option. To avoid the possibility of electrical shock or damaging short circuits, always unplug the device before opening the case. Please refer to the respective device manuals for full safety information and instruction on how to open the case. Signal wiring changes external to the case can be made safely while the units are under power.

2. JUMPERS ON SERIAL METER BOARDS

USB Board &
Basic Ethernet Board

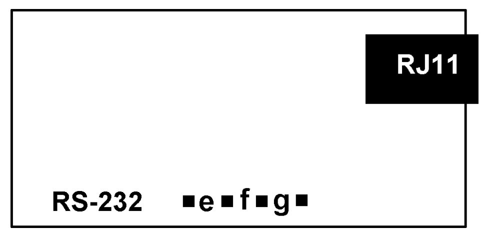
No jumpers needed.



RS232 Board

e - Normal operation.
f - Slave display to RS232 from another meter.
g - Pull-up resistor on RTS line.

Note: Board is shipped with jumpers **e** and **g** installed



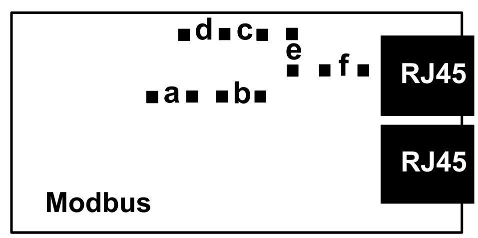
RS485-Modbus Board, Full Duplex Operation

b & e - Bias jumpers should be installed on 1 board.
a & d - Installed on last meter in long cable run.

RS485-Modbus Board, Half Duplex Operation

b & e - bias jumpers installed on 1 board.
c & f - installed for half duplex operation.
a - installed on last meter in line with long cable runs.

Note: Board is shipped with no jumpers installed.



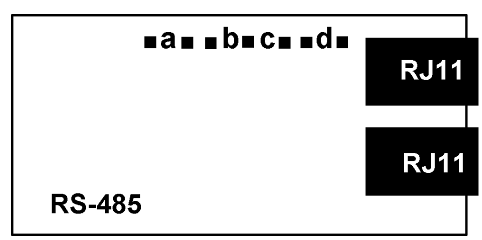
RS485 Board, Full Duplex Operation

b & d - Installed on last meter in long cable run.

RS485 Board, Half Duplex Operation

a & c - Installed for half duplex operation.
d - Installed on last meter in line with long cable runs.

Note: Board is shipped with no jumpers installed.



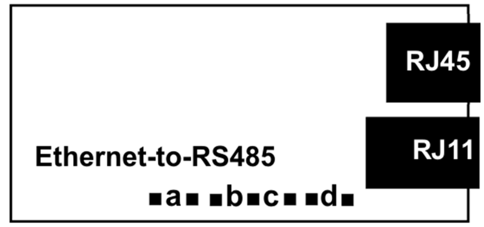
Ethernet-to-RS485 Device Converter Board
& USB-to-RS485 Device Converter Board

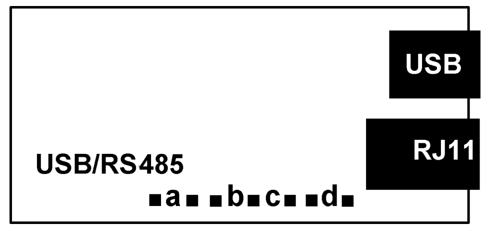
Full Duplex Operation

No jumpers for short cable runs.
Add **b & d** for long cable runs.

Half Duplex Operation

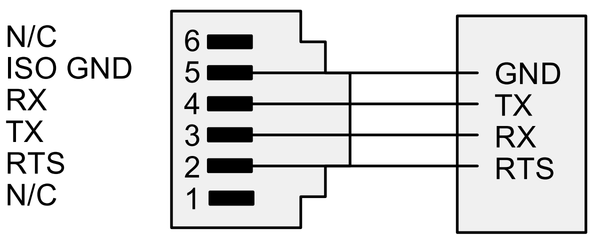
a & c - Installed for half duplex operation.
d - Installed on last meter in line with long cable runs.





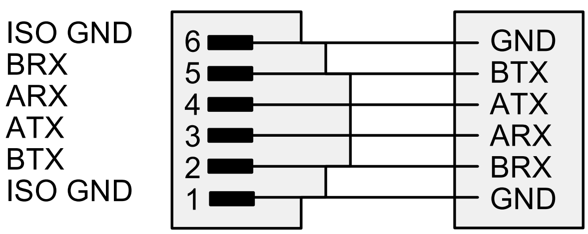
3. CONNECTOR WIRING, SERIAL BOARD TO COMPUTER

RS232 INTERFACE **Computer**

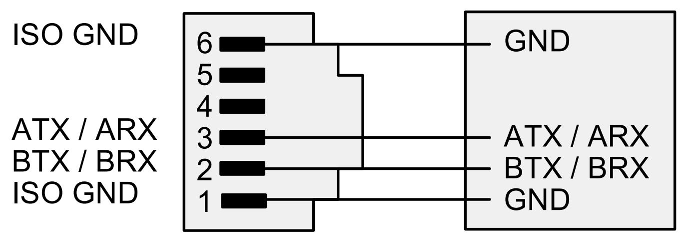


RJ11-to-DB9 RS232 cable with rear view of DB9 connector to PC

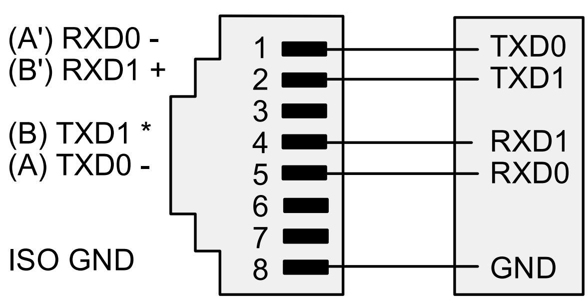
RS485 INTERFACE - FULL DUPLEX



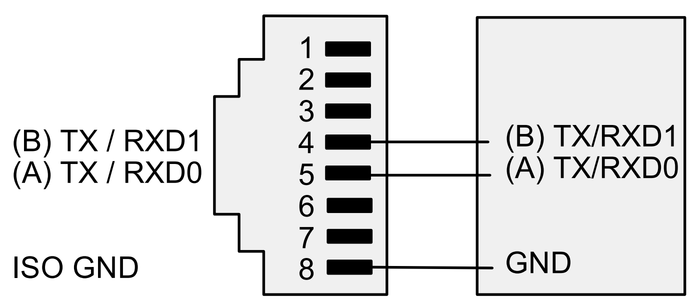
RS485 INTERFACE - HALF DUPLEX



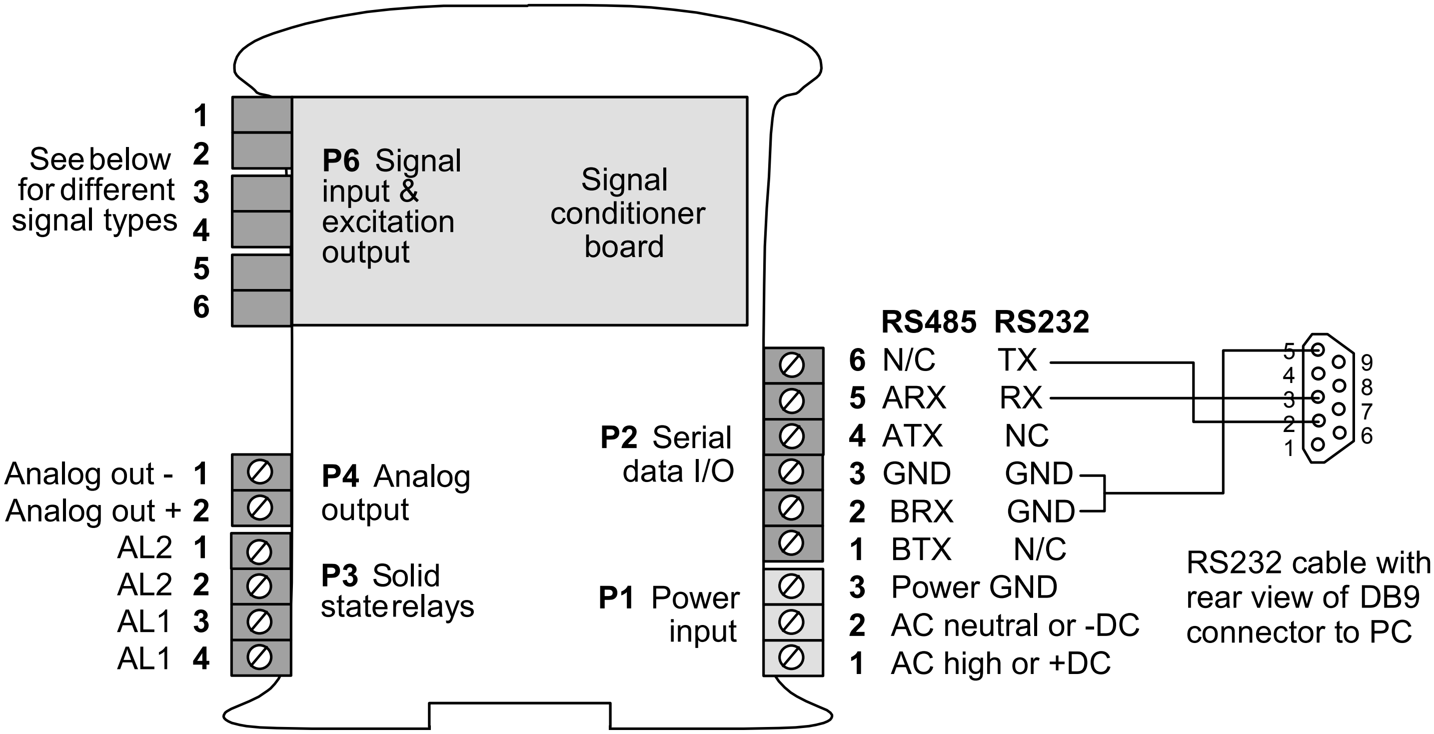
RS485-MODBUS - FULL DUPLEX

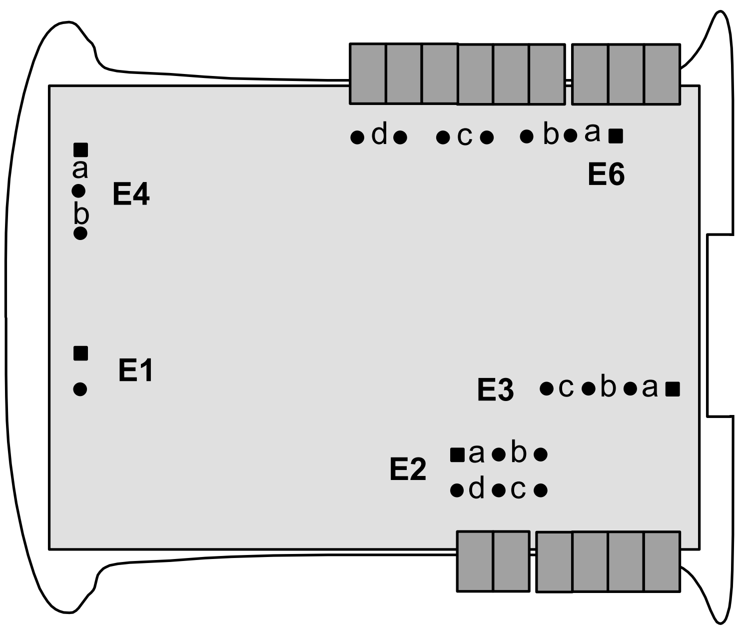


RS485-MODBUS - HALF DUPLEX



4. TRANSMITTER CONNECTOR WIRING





* The termination resistor jumper settings should only be selected if the transmitter is the last device on an RS485 line longer than 200 feet (60 m).

** Or jumper external BTX to BRX and ATX to ARX (same effect as internal jumpers).

Serial Signal	Duplex	Jumpers	Termination Resistor*
RS485	Full	None	E6 a = Transmit E6 c = Receive
	Half	E6 b + d**	E6 c
RS232	Full	None	None

Serial Signal	Duplex	Jumpers	Termination Resistor*
RS485	Full	None	E6 a = Transmit E6 c = Receive
	Half	E6 b + d**	E6 c
RS232	Full	None	None

* The termination resistor jumper settings should only be selected if the transmitter is the last device on an RS485 line longer than 200 feet (60 m).

** Or jumper external BTX to BRX and ATX to ARX (same effect as internal jumpers).

To reset communications to 9600 baud, command mode, Custom ASCII protocol, and Address 1, place a jumper at E1 and power up the transmitter.

Analog Output	Jumpers
Current	E2 a + d
Voltage	E2 b + c

Excitation Output*	Jumpers
5V, 100 mA	E3 a + c; E4 a
10V, 120 mA	E3 a + c; E4 b
24V, 50 mA	E3 b, E4 none

* Attempting to draw more than the rated current will shut down the output.

5. PROGRAMMING YOUR SERIAL DEVICE

OVERVIEW

Digital panel meters, counters, timers and transmitters are easily programmed via their serial port using Windows-based **Instrument Setup (IS)** software, which provides a graphical user interface and is available at no charge. This software allows uploading, editing, downloading and saving of setup data, execution of commands under computer control, listing, plotting and graphing of data, and computer prompted calibration. Digital panel meters, counters and timers can also be programmed via their 4-key front panel as explained in their respective manuals. For Ethernet, please see our separate **Ethernet Manual**.

GETTING STARTED WITH INSTRUMENT SETUP SOFTWARE

To install IS software, download the file *instrument.exe* from our website, double-click on the file name to extract three files, double-click *on setup.exe*, and follow the prompts. To launch IS software, press *Start* => *Programs* => *IS2* => *IS2*. Establish communications by selecting matching settings between the instrument and PC, and click on *Establish*. Once communications have been established, click on *Main Menu*.

The best way to learn IS software is to experiment with it. From the Main Menu, click on *Get Setup* to retrieve (or get) the existing setup data from your device. Click on *View* = > *Setup* to bring up screens which allow you to edit the setup file using pull-down menus and other selection tools. You can save your file to disk by clicking on *File* = > *Save Setup*. You can download (or put) your edited file into the device by clicking on *Put Setup*. Programmable items will only be displayed if the appropriate hardware has been detected, such as the dual relay option for meters. Pressing the *F1* key at any time will bring up detailed help information.

An analog output is defined in two steps. The input to the device is first scaled to a digital reading in engineering units, and this reading is then scaled to the analog output. The digital reading is also used for setpoint control and can be transmitted as serial data.

ADDITIONAL FEATURES

- **The Commands pull-down menu** allows you to execute certain functions by using your computer mouse. The *Commands* pull-down menu will be grayed out unless a *Get Setup* has been executed.

- **The Readings pull-down menu** provides three formats to display input data on your PC monitor. In all formats, use the *Pause* and *Continue* buttons to control the timing of data collection, then press *Print* for a hardcopy on your PC printer. **List** presents the latest digital readings in a 20-row by 10-column table. **Plot** generates a plot of digital readings vs. time in seconds, like an oscilloscope. **Graph** generates a histogram, where the horizontal axis is the reading and the vertical axis is the number of readings.

6. FRONT PANEL SETUP, SERIAL COMMUNICATIONS

6.1 FRONT PANEL SETUP, DIGITAL PANEL METERS & SCALE METER ONLY

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
SEr 1 Press until *Ser 1* is displayed. Fixed Parameters: - No parity - 8 data bits - 1 stop bit	000 Output filtering	0 Send unfiltered signal 1 Send filtered signal
	000 Baud rate	0 300 baud 1 600 baud 2 1200 baud 3 2400 baud 4 4800 baud 5 9600 baud 6 19200 baud
	000 Output update rate, Continuous Data Output Mode.	60 Hz / 50 Hz 0 0.017 sec / 0.020 sec 1 0.28 sec / 0.34 sec 2 0.57 sec / 0.68 sec 3 1.1 sec / 1.4 sec 4 2.3 sec / 2.7 sec 5 4.5 sec / 5.4 sec 6 9.1 sec / 10.9 sec 7 18.1 sec / 21.8 sec 8 36.6 sec / 43.5 sec 9 72.5 sec / 86.7 sec
SEr 2 Serial Setup 2	0000 Line feed	0 No <LF> following <CR> 1 <LF> following <CR>
	0000 Alarm data with readings	0 No alarm data with reading 1 Alarm data with reading
	0000 Control of data output	0 Continuous data output 1 Data output on ASCII command only
	0000 Meter address	Select 1 thru F for addresses 1 thru 15. Select 0. thru F. (with decimal point) for addresses 16 thru 31.

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
SEr 3 Serial Setup 3	00000 RS485 half or full duplex	0 Full duplex 1 Half duplex
	00000 Special start & stop char. (entered using Instrument Setup Software)	0 * Start, <CR> Stop characters 1 Special Start & Stop characters
	00000 RTS mode (for RS232)	0 Normal non-latching RTS 1 Single transmission, latching RTS
	00000 Termination characters	0 Only at end of all items 1 At end of each item
	00000 Data sent, digital panel meter only	0 Reading 1 Peak 2 Valley 3 Reading + Peak 4 Reading + Valley 5 Reading + Peak + Valley
	00000 Data sent, scale meter only	0 Net + Gross 1 Net only 2 Gross only 3 Peak only (Net or Gross) 4 Net + Gross + Peak 5 Valley only
SEr 4 Serial Setup 4	000 Modbus ASCII gap timeout*	0 1 sec 1 3 sec 2 5 sec 3 10 sec
	000 Serial protocol	0 Custom ASCII 1 Modbus RTU* 2 Modbus ASCII*
	000 Parity	0 None 1 Odd (Modbus only)* 2 Even (Modbus only)*
Addr Modbus Address*	000 000 000 Select digit to flash.	158 Select 0 through 9 for flashing digit. Address range is 1 to 247.

* Modbus is not applicable to our weight meter.

6.2 FRONT PANEL SETUP, COUNTERS & TIMERS ONLY

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
Ser 1 Serial Setup 1. Press ↳ until *Ser 1* is displayed. Fixed Parameters - No parity - 8 data bits - 1 stop bit	000 Output filtering	0 Send unfiltered signal 1 Send filtered signal
	000 Baud rate	0 300 baud 1 600 baud 2 1200 baud 3 2400 baud 4 4800 baud 5 9600 baud 6 19200 baud
	000 Output update rate, Continuous Data Output Mode.	60 Hz / 50 Hz 0 0.017 sec / 0.020 sec 1 0.28 sec / 0.34 sec 2 0.57 sec / 0.68 sec 3 1.1 sec / 1.4 sec 4 2.3 sec / 2.7 sec 5 4.5 sec / 5.4 sec 6 9.1 sec / 10.9 sec 7 18.1 sec / 21.8 sec 8 36.6 sec / 43.5 sec 9 72.5 sec / 97 sec
Ser 2 Serial Setup 2	0000 Line feed	0 No <LF> after <CR> 1 <LF> after <CR>
	0000 Alarm data with readings	0 No alarm data 1 Alarm data with reading
	0000 Control of data output	0 Continuous data output 1 Data output on ASCII command only
	0000 Meter address with Custom ASCII protocol	Select 1 thru F for addresses 1 thru 15. Select 0. thru F. (with decimal point) for addresses 16 thru 31.
Ser 3 Serial Setup 3	00000 RS485 half or full duplex	0 Full duplex 1 Half duplex
	00000 Special start & stop char. (entered using Instrument Setup Software)	0 Standard continuous mode 1 Special start & stop characters

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
Ser 3 (continued)	00000 RTS mode for RS232	0 Normal non-latching RTS 1 Single transmission, latching RTS
	00000 Termination characters	0 Only at end of all items 1 At end of each item
	00000 Data sent in continuous mode	0 All active items 1 Item #1 only 2 Item #2 only (if active) 3 Item #3 only (if active) 4 Peak only 5 Displayed item 6 Valley only 7 All active items + Peak
Ser 4 Serial Setup 4	000 Modbus ASCII gap timeout	0 1 sec 1 3 sec 2 5 sec 3 10 sec
	000 Serial protocol	0 Custom ASCII 1 Modbus RTU 2 Modbus ASCII
	000 Parity	0 None 1 Odd (Modbus only) 2 Even (Modbus only)
Addr Modbus Address	000 000 000 Select digit to flash.	158 Select 0 thru 9 for flashing digit. Address range is 1 to 247.

7. CUSTOM ASCII COMMUNICATION PROTOCOL

7.1 SERIAL COMMUNICATION FORMAT

The Custom ASCII serial communication format for RS232, RS485 and USB is the following:

Duplex .... Full duplex for RS232 & RS485. Half duplex selectable for RS485.
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

7.2 MEASUREMENT DATA FORMAT

The basic measurement data format consists of 8 ASCII characters for the DPM, such as <SP>999.99 <CR> and 9 characters for the counter, such as <SP> 9999.99<CR>, where <SP> is the space character and <CR> is the carriage return character. The first character is always a space character or minus sign. A decimal point is always furnished, even when it follows the last digit.

Adding a Line Feed Character to the Basic Format

Printers and other devices that receive the measurement data may require a line feed character <LF> following the <CR>. The line feed character may be selected in “Ser 2”.

Adding a Coded Data Character to the Basic Format

It is possible to add a coded character from A to h to the data string according to the table to the right to indicate the alarm and overload status of the device. If used, this character precedes the <CR>, so it is the last printable character in the string. With the optional <LF> and coded character selected, the data string will consist of 10 characters for the DPM: <SP>999.99A<CR><LF> and 11 characters for the counter: <SP>9999.99A<CR><LF>.

Alarm # 4	3	2	1	Alarm with No Overload	Alarm with Overload
0	0	0	0	A	E
0	0	0	1	B	F
0	0	1	0	C	G
0	0	1	1	D	H
0	1	0	0	I	M
0	1	0	1	J	N
0	1	1	0	K	O
0	1	1	1	L	P
1	0	0	0	Q	U
1	0	0	1	R	V
1	0	1	0	S	W
1	0	1	1	T	X
1	1	0	0	a	e
1	1	0	1	b	f
1	1	1	0	c	g
1	1	1	1	d	h

For example, a coded character “G” indicates that Alarm 2 only is set and that the DPM is in overload condition. This information is useful when data is supplied to a computer for listing and analysis, or when data 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 (or “Item”) with each reading, as selected in “Ser 3”. In the counter, there can be up to 3 Items plus Peak and Valley values, depending on the selected Function. The scale meter can transmit Net, Gross and Peak weight.

Values are transmitted in a continuous string with no space between them. If the 5th digit in “Ser 3” is set to 1, the termination characters of <CR> and optional <LF> appear after each value. If the 5th digit is et to 0, the termination characters appear only once at the end of the string. In either case, if included, the coded character appears at the end of the last value only.

7.3 NETWORK CONFIGURATIONS

The meters and transmitters can operate in a point-to-point mode using RS-232 or RS-485, or in a multi-point mode using RS-485.

The point-to-point mode is a direct connection between a computer (or other digital device) and the meter or transmitter.

The multi-point mode is a connection from a host computer to a multiplicity of meters or transmitters bused together with their inputs and outputs connected in parallel. For long cable runs, the first and last devices should have a termination resistor installed. It is necessary to set up each device on the bus with a different address from 1 to 31. To command a particular device, its address is used in conjunction with the command, and only that device responds. The outputs of all of the devices on the bus are set to a high impedance state, except the device being addressed. The device addresses range from 1 to 31. A special address to which all meters respond is 0 and should not be used in the multi-point mode. Addressing of meters can be set in “Ser 2”.

A device 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.

7.4 OPERATING MODES

The meters and transmitters can operate in a Continuous Mode or a Command Mode.

In the Continuous Mode, measurements are continuously transmitted by the meter in a standard data format. Please see the next manual section.

In the Command Mode, the meter does not send any data automatically, but responds to commands received from a host computer. Please see the manual section following the Continuous Mode.

8. CONTINUOUS MODE

8.1 OVERVIEW

In the Continuous Operating Mode, measurements are continuously transmitted by the meter or transmitter in a standard data format using printable ASCII characters at a user-selectable rate ranging from 50 or 60 Hz line frequency down to one measurement every 72 seconds. This data may be received by a remote display at a distant location, by a printer for data logging purposes, or by a host computer for data analysis or system control.

Both hardware (RTS) and software (XON/XOFF) handshaking are available for RS232, but neither is available for RS485.

8.1 METERS OR TRANSMITTERS WITH DPM OR SCALE METER MAIN BOARD

The transmission rate of the measurement data can be selected in “Ser 1”. The meter conversion rate equals the 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	0.021s / .018 s	9600	9600	19200
1	0.34 s / 0.28 s	600	600 / 1200	1200
2	0.68 s / 0.57 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	10.9 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

8.2 METERS OR TRANSMITTERS WITH COUNTER / TIMER MAIN BOARD

The transmission rate of the 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 Rate	Time 1 Item	Min Gate	Time 2 Items	Min Gate	Time 3 Items	Min Gate	Time 4 Items	Min Gate
300	0.37s	0.34s	0.70s	0.67s	10.03s	1.00s	1.37s	1.34s
600	0.18s	0.15s	0.35s	0.32s	0.52s	0.49s	0.68s	0.65s
1200	0.09s	0.06s	0.18s	0.15s	0.26s	0.23s	0.34s	0.31s
2400	0.05s	0.02s	0.09s	0.06s	0.13s	0.10s	0.17s	0.14s
4800	0.02s	0.01s	0.04s	0.01s	0.07s	0.04s	0.09s	0.06s
9600	0.01s	0.01s	0.02s	0.01s	0.03s	0.01s	0.04s	0.01s
19200	0.01s	0.01s	0.01s	0.01s	0.02s	0.01s	0.01s	0.01s

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.

8.3 RTS CONTROL

RTS control does not apply to transmitter, where the RTS line is always held high, nor to RS485. DPMs and counter / timers have two RS232 RTS modes: unlatched and latched. These modes are selected in “Ser3”.

In the unlatched mode, the measurement transmission is enabled by a high RTS level and is disabled by a low RTS level. When disabled, any character being sent is completed. 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. **In the latched mode,** the RTS input is polled every 3.3 ms. 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. If it is true, a complete measurement transmission (from 1 to 4 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.

8.3 XON / XOFF CONTROL

Applicable to RS232, not RS485. A measurement transmission is enabled by the receipt of an ASCII XON character. It is disabled by the receipt of an ASCII XOFF character.

9. COMMAND MODE

9.1 OVERVIEW

In the Command Mode, the device does not send any data automatically, but responds to commands received from a host computer. These commands can be:

- To transmit the latest, peak, or valley measurement.
- To reset the meter completely or just the peak and valley values and latched alarms.
- To display a value sent from the computer.
- To transmit present setup parameters.
- To receive new setup parameters.
- 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”. The meter will not respond to a command in the Continuous Mode, except the command “A1”, which puts the meter into the Command Mode.

9.2 COMMAND MODE FORMAT

The minimum format is 4 characters. Example: *5A1

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.

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 #	Meter 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 #	Meter 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 VALUES

Get reading**	*1B1
Peak reading	*1B2
Valley reading	*1B3

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

REQUEST SCALE METER VALUES

Get reading**	*1B1
Net only	*1B2
Gross only	*1B3
Peak only	*1B4

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

REQUEST COUNTER VALUES

All active items 1, 2 or 3	*1B0	
Item 1	*1B1	
Item 2	*1B2	
Item 3	*1B3	
Peak	*1B4	
Displayed item	*1B5	
Valley	*1B6	
All active items + Peak + Valley	*1B7	

RESET FUNCTIONS, DPM & SCALE METER

Cold reset	*1C0	Reads NVMEM into RAM locations after RAM is zeroed.
Latched alarms reset	*1C2	
Peak value reset	*1C3	
Remote display reset	*1C4	
External Input B true	*1C5	
External Input B false	*1C6	
External Input A true	*1C7	
External Input A false	*1C8	
Valley reset	*1C9	
Tare function	*1CA	
Tare reset	*1CB	

RESET FUNCTIONS, COUNTER / TIMER

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. Removes Alarm View or Peak View if on.
External Input B true	*1C5	
External Input B false	*1C6	
External Input A true	*1C7	
External Input A false	*1C8	
Valley value reset	*1C9	
Store totals & reset	*1CA	

9.3 READING AND WRITING TO RAM AND NONVOLATILE MEMORY

CHARACTERS 1, 2

The Recognition character and Meter Address Code are the same as 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)
R Read bytes from Upper RAM Memory
Q Write bytes to Upper RAM Memory
X Read words from Non-Volatile Memory
W Write words to Non-Volatile Memory

CHARACTER 4: Number of bytes (G, F, R, Q) or words (X, W)

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 for the RAM MEMORY ADDRESSES and NONVOLATILE MEMORY ADDRESSES with their respective data definitions.

CHARACTERS 7 & UP: Data to be written (F, Q, W).

GENERAL, READING AND WRITING 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 are 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 lower RAM data *1Gnaa
Write lower RAM data *1Fnaa<data>
Read upper RAM data *1Rnaa
Write upper RAM data *1Qnaa<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.

GENERAL, READING AND WRITING 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 (Meter reset occurs after all data is read.)
Write non-volatile memory data *1Wnaa <data> (Meter reset occurs after data is written.)
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 NONVOLATILE MEMORY ADDRESSES.

9.4 COMMAND MODE FOR REMOTE DISPLAY OPERATION OF DPM

OVERVIEW

A DPM can serve as a remote display that responds to values sent via serial communications by a PC or by another DPM in a Master-Slave configuration. In one application, the DPM sends readings to a PC, which then processes the readings and transmits values back to the DPM for display. There are 2 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 its 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).

A 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 negative 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.

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 at the end.
A = Alarm character as defined in 8.4, Mode 1.

9.5 COMMAND MODE FOR REMOTE DISPLAY OPERATION OF COUNTER / TIMER

The Counter has 13 Display Modes (0-12). Modes 0-5 are normal measurement modes. Modes 6-12 are dedicated to Remote Display without making any normal readings. In any of the 13 modes, remote display data may be received via RS-232 or RS-485 and be 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.** Overrides the normal display reading only.
2. **K Command.** The value is not displayed, but is stored as Item 3 if Item 3 is not being used. It may then become the source, if selected, for the Alarm comparison and the Analog Output. Item 3 is normally only used 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, this character 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 their internal comparisons, the Item 3 value to zero, and the Analog Output as scaled for zero input. 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 operation 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 point-to-point connection. In addition to being displayed, that value is put into Item 3, where it may be selected for Alarm comparisons and/or 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. Using this mode, multiple slave counters connected to a Host Counter could each be displaying a different Item value. Also, the extracted value is put into Item 3 where it may be selected for Alarm comparisons and/or 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.

Mode 12 - Remote display "C" allows extraction of data from an ASCII string that contains multiple data values or non-numeric characters. It can accommodate selected Remote Start and Remote Stop characters. Any number of characters between the Remote Start character and the data can be masked OFF. Up to 8 display characters (including sign and DP) can be masked ON. Any number of characters between the last displayed character and the Remote Stop character can be masked OFF.

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

1. Remote Start character (set to 00 if none desired).
2. Remote 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 Remote 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 the Remote Display C mode. These programs may be downloaded from our website.

COMMAND 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 negative 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. Example:

SDDDDDD.SDDDDDD.SDDDDDD.SDDDDDD.A<CR><LF>
<LF> optional, "Ser 3" "Digit 5" = 0, termination characters 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, termination characters at end of each data item.

9.6 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 Character	Continuous Transmission Readings	
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.

10. APPENDIX A: DPM MEMORY ADDRESSES AND DATA DEFINITIONS

10.1 DPM 1-BYTE RAM MEMORY DATA

(L) = Lower memory, (U) = Upper memory.

The bit assignments below constitute an 8-bit binary number, which needs to be converted to Hex using a program such a Scientific Calculator under MS Windows Accessories. To change an Item in DPM RAM Memory, write the converted Hex value to the Hex Address shown in the left column. To change an Item in Nonvolatile Memory, go to table 10.4, read the existing two-byte word (MS byte and LS byte) from the DPM for the Hex Address which includes the Item to be changed, edit the MS or LS byte as appropriate, and write the edited word back to the Hex Address. Be careful not to overwrite the Sig Cond Type LS byte under Hex Address 15.

Hex Address	Item Name	Bit Assignment								
DE (L)	Configuration	Bit 7	6	5	4	3	2	1	0	
									0	Linear data
									1	Custom curve (Extended DPM)
								0		Spare
							0			No Auto-Tare
							1			Auto-Tare
					0	0				Peak button displays Peak
					0	1				Peak button displays Valley
					1	0				Peak b. displays Peak then Valley
					1	1				Peak button tares the meter
		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
BF (L)	Analog Setup	Bit 7	6	5	4	3	2	1	0	
									0	Analog output unfiltered
									1	Analog output filtered
							0	0		0-20 mA current output
							0	1		0-10V voltage output
							1	0		4-20 mA current output
							1	1		-10V to +10V output

		Bit 7	6	5	4	3	2	1	0	
69 (L)	Serial Cnfg3						0	0	0	Send Reading
							0	0	1	Send Peak
							0	1	0	Send Valley
							0	1	1	Send Reading + Peak
							1	0	0	Send Reading + Valley
							1	0	1	Send Reading + Peak + Valley
						0				<CR> or <CR><LF> at end of all Items
						1				<CR> or <CR><LF> at end of each Item (if no Alarm character)
					0					Non-latching RTS
					1					Latching RTS
				0						Normal continuous TX
				1						Special Start & Stop characters
			0							Full duplex
		1								Half duplex
35 (L)	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 (L)	Lockout2	Bit 7	6	5	4	3	2	1	0	Menu item & front panel lockout
	0 = unlocked								1	Serial configuration
	1 = locked							1		Analog output scaling
							1			Alarm setpoint programming
						1				Alarm setup
					1					Front panel DPM reset
				1						Front panel Peak & Alarm reset
			1							View alarm setpoints
		1								View Peak value & Tare function
33 (L)	Lockout1	Bit 7	6	5	4	3	2	1	0	Menu item & front panel lockout
	0 = unlocked								1	Offset, Lo & Hi readings
	1 = locked							1		Scale, Lo In, Hi In
							1			Filter Setup
						1				Setup, Config & Decimal Point
					1					InPut Menu Item

32 (L)	Serial Cnfg2	Bit 7	6	5	4	3	2	1	0		
					X	X	X	X	X	Binary Custom ASCII addr. 0-31	
				0						Continuous mode	
				1						Command mode	
			0							Alarm data not included with rdg.	
			1							Alarm data included with rdg.	
		0								No <LF> following <CR>	
		1								<LF> following <CR>	
31 (L)	Serial Cnfg1	Bit 7	6	5	4	3	2	1	0	<u>Continuous Output Data Rate</u>	
										<u>60 Hz</u>	<u>50 Hz</u>
						0	0	0	0	0.017s	0.02s
						0	0	0	1	0.28	0.34
						0	0	1	0	0.57	0.68
						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	1:13	1:27
						1	0	1	0	2:25	2:54
						1	0	1	1	4:50	5:48
						1	1	0	0	9:40	11:36
						1	1	0	1	19:20	23:13
						1	1	1	0	38:41	46:25
						1	1	1	1	1:17:21	1:32:51
			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	
		0								Send unfiltered value	
		1								Send filtered value	

2F (L)	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	0.07 s	0.085 s
						0	0	1	1	Moving average	0.14	0.17
						0	1	0	0	Moving average	0.28	0.34
						0	1	0	1	Moving average	0.57	0.68
						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		
					0					Low adaptive threshold		
					1					High adaptive threshold		
				0						Display batch		
				1						Display filtered signal		
			0							Take peak of unfiltered signal		
			1							Take peak of filtered signal		
		0								Alarm from unfiltered signal		
		1								Alarm from filtered signal		
2D (L)	Setup	Bit 7	6	5	4	3	2	1	0	EXT IN 1	EXT IN 2	BOTH
						0	0	0	0	Mtr Reset	Mtr Hold	Mtr Reset
						0	0	0	1	Fct Reset	Rd Pk/Vl	Mtr Reset
						0	0	1	0	Mtr Hold	Rd Pk/Vl	Fct Reset
						0	0	1	1	Mtr Hold	Tare	Mtr Reset
						0	1	0	0	Rd Pk/Vl	Tare	Fct Reset
						0	1	0	1	Tare	Mtr Reset	Mtr Reset
						0	1	1	0	DP2	DP3	DP4
						0	1	1	1	DP3	DP4	DP5
						1	0	0	0	Fct Reset	Disp Blank	Mtr Reset
						1	0	0	1	Mtr Hold	Disp Blank	Mtr Reset
						1	0	1	0	Rd Pk/Vl	Disp Blank	Fct Reset
						1	0	1	1	Tare	Disp Blank	Mtr Reset
						1	1	0	0	Rd Valley	Read Peak	Fct Reset
						1	1	0	1	Tare	Tare Reset	Mtr Reset
				0	0					Scale using Scale & Offset method		
				0	1					Scale using Coordinates of 2 Points method		
				1	1					Scale using Reading Coordinates of 2 Points		
		0								60 Hz power		
		1								50 Hz power		

09 (U)	Setup1*	Bit 7	6	5	4	3	2	1	0			
	* Cannot be written to RAM							0	0	4-1/2 digit display (0.1° temp.)		
								0	1	Remote display		
								1	0	4-1/2 digit count by 10 (0.01° t.)		
								1	1	3-1/2 digit display (1° temp.)		
0D (U)	Alarm Confg4	Bit 7	6	5	4	3	2	1	0	<u>Alarm Trigger Delay</u>		
											<u>60 Hz</u>	<u>50Hz</u>
							0	0	0		0.018 s	0.021 s
							0	0	1		0.035	0.043
							0	1	0		0.07	0.085
							0	1	1		0.14	0.17
							1	0	0		0.28	0.34
							1	0	1		0.56	0.68
							1	1	0		1.13	1.36
							1	1	1		2.27	2.72
				0	0	0				AI3 Band Dev, AI4 Band Dev		
				0	0	1				AI3 Hysteresis, AI4 Band Dev		
				0	1	0				AI3 Band Dev, AI4 Hysteresis		
				0	1	1				AI3 Hysteresis, AI4 Hysteresis		
				1	0	0				No deviation in menus or calc		
0C (U)	Alarm Confg3	Bit 7	6	5	4	3	2	1	0			
						0	0	0	0	AI3 Hi active, AI4 Hi active		
						0	0	0	1	AI3 Lo active, AI4 Hi active		
						0	0	1	0	AI3 Disabled, AI4 Hi active		
						0	1	0	0	AI3 Hi active, AI4 Lo active		
						0	1	0	1	AI3 Lo active, AI4 Lo active		
						0	1	1	0	AI3 disabled, AI4 Lo active		
						1	0	0	0	AI3 Hi active, AI4 disabled		
						1	0	0	1	AI3 Lo active, AI4 disabled		
						1	0	1	0	AI3 disabled, AI4 disabled		
				0	0					AI3 non-latch, AI4 non-latch		
				0	1					AI3 latch, AI4 non-latch		
				1	0					AI3 non-latch, AI4 latch		
				1	1					AI3 latch, AI4 latch		
		0	0							Relay3 On when AI3 active, Relay4 On when AI4 active		
		0	1							Relay3 Off when AI3 active, Relay4 On when AI4 active		
		1	0							Relay3 On when AI3 active, Relay4 Off when AI4 active		
		1	1							Relay3 Off when AI3 active, Relay4 Off when AI4 active		

0B (U)	Alarm Confg2	Bit 7 6 5 4 3 2 1 0 Alarm Trigger Delay 60 Hz 50Hz 0 0 0 0.018s 0.021s 0 0 1 0.035 0.043 0 1 0 0.07 0.085 0 1 1 0.14 0.17 1 0 0 0.28 0.34 1 0 1 0.56 0.68 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 Hysteresis, Al2 Band Dev 0 1 0 Al1 Band Dev, Al2 Hysteresis 0 1 1 Al1 Hysteresis, Al2 Hysteresis 1 0 0 No deviation in menus or calc
0A (U)	Alarm Confg1	Bit 7 6 5 4 3 2 1 0 0 0 0 0 Al1 Hi active, Al2 Hi active 0 0 0 1 Al1 Lo active, Al2 Hi active 0 0 1 0 Al1 Disabled, Al2 Hi active 0 1 0 0 Al1 Hi active, Al2 Lo active 0 1 0 1 Al1 Lo active, Al2 Lo active 0 1 1 0 Al1 disabled, Al2 Lo active 1 0 0 0 Al1 Hi active, Al2 disabled 1 0 0 1 Al1 Lo active, Al2 disabled 1 0 1 0 Al1 disabled, Al2 disabled 0 0 Al1 & Al2 non-latching 0 1 Al1 latching, Al2 non-latching 1 0 Al1 non-latching, Al2 latching 1 1 Al1 & Al2 latching 0 0 Relay1 On when Al1 active, Relay2 On when Al2 active 0 1 Relay1 Off when Al1 active, Relay2 On when Al2 active 1 0 Relay1 On when Al1 active, Relay2 Off when Al2 active 1 1 Relay1 Off when Al1 active, Relay2 Off when Al2 active

00 (U)	Serial Cnfg4	Bit 7 6 5 4 3 2 1 0	Serial Protocol
		0 0	No Parity
		0 1	Odd Parity
		1 0	Even Parity
		0 0	Custom ASCII protocol (8 bits)
		0 1	Modbus RTU protocol (8 bits)
		1 0	Modbus ASCII protocol (7 bits)
		0 0	1 s Modbus ASCII gap timeout
		0 1	3 s Modbus ASCII gap timeout
		1 0	5 s Modbus ASCII gap timeout
		1 1	10 s Modbus ASCII gap timeout
35 (U)	Modbus Addr.	00 to FF	Modbus address 0-255 (in Hex format)

10.2 DPM 3-BYTE RAM MEMORY DATA

Format for all items except Scale Factor:	MS byte	Mid byte	LS byte
	XX	XX	XX
Format for Scale Factor:	*X	XX	XX

The 4-bit MS nibble “*” sets the polarity and decimal point according to the following table:

Positive	Negative	Decimal Point
1	9	XXXXX.
2	A	XXXX.X
3	B	XXX.XX
4	C	XX.XXX
5	D	X.XXXX
6	E	.XXXXX

Note: Hex values are 2's complement and absolute values.

10.3 DPM HEX ADDRESSES

MS	Mid	LS	Description
A1 (L)	A0	9F	Analog high value
9E (L)	9D	9C	Analog low value
1B (U)	1A	19	Deviation, Alarm4
18 (U)	17	16	Deviation, Alarm3
9B (L)	9A	99	Deviation, Alarm2
98 (L)	97	96	Deviation, Alarm1
8F (L)	8E	8D	Offset value
8C (L)	8B	8A	Scale factor
15 (U)	14	13	Setpoint4
12 (U)	11	10	Setpoint3
89 (L)	88	87	Setpoint2
86 (L)	85	84	Setpoint1

10.4 DPM NONVOLATILE MEMORY ADDRESSES (2 bytes/address)

Hex Addr	MS Byte	LS Byte	Stored As
75	Setup1	Serial Confg3	Bits
74	Deviation4 Byte 3	Deviation4 Byte 2	Magnitude
73	Deviation4 Byte 1	Deviation3 Byte 3	Magnitude
72	Deviation3 Byte 2	Deviation3 Byte 1	Magnitude
71	Setpoint4 Byte 3	Setpoint4 Byte 2	2's Complement
70	Setpoint4 Byte 1	Setpoint Byte 3	2's Complement
6F	Setpoint3 Byte 2	Setpoint3 Byte 1	2's Complement
6E	Alarm Cnfg4	Alarm Confg 3	Bits
6D	Version (read only)	M Type (read only)	Byte
36	Tare Setup	Analog Type	Bits
35	Serial Cnfg4 (Bits)	Modbus Address (Byte)	
18	Deviation2 Byte 3	Deviation2 Byte 2	Magnitude
17	Deviation2 Byte 1	Deviation1 Byte 3	Magnitude
16	Deviation1 Byte 2	Deviation1 Byte 1	Magnitude
15	Configuration	Sig Cond Type (do not change)	Bits
14	Analog Setup	System Decimal Point	Bits
13	Lockout2	Lockout1	Bits
12	Serial Cnfg2	Serial Cnfg1	Bits
11	Options	Filter	Bits
10	Setup	Input Type	Bits
0F	Alarm Cnfg Byte 2	Alarm Cnfg1	Bits
0E	Analog High Byte 3	Analog High Byte 2	2's Complement
0D	Analog High Byte 1	Analog Low Byte 3	2's Complement
0C	Analog Low Byte 2	Analog Low Byte 1	2's Complement
0B	High Read Byte 3	High Read Byte 2	2's Complement
0A	High Read Byte 1	High In Byte 3	2's Complement
09	High In Byte 2	High In Byte 1	2's Complement
08	Low Read Byte 3	Low Read Byte 2	2's Complement
07	Low Read Byte 1	Low In Byte 3	2's Complement
06	Low In Byte 2	Low In Byte 1	2's Complement
05	Offset Byte 3	Offset Byte 2	2's Complement
04	Offset1 (2's Comp)	Scale Factor3 (Sign+DP+Mag)	
03	Scale Factor2	Scale Factor1	Sign+DP+Mag
02	Setpoint2 Byte 3	Setpoint2 Byte 2	2's Complement
01	Setpoint2 Byte 1	Setpoint1 Byte 3	2's Complement
00	Setpoint1 Byte 2	Setpoint1 Byte 1	2's Complement

11. APPENDIX B: COUNTER / TIMER MEMORY ADDRESSES AND DATA DEFINITIONS

11.1 COUNTER / TIMER 1-BYTE RAM MEMORY DATA

(L) = Lower memory, (U) = Upper memory

The bit assignments below constitute an 8-bit binary number, which needs to be converted to Hex using a program such a Scientific Calculator under MS Windows Accessories. To change an Item in Counter / Timer RAM Memory, write the converted Hex value to the Hex Address shown in the left column. To change an Item in Nonvolatile Memory, go to table 11.4, read the existing two-byte word (MS byte and LS byte) from the Counter / Timer for the Hex Address which includes the Item to be changed, edit the MS or LS byte as appropriate, and write the edited word back to the Hex Address.

Hex Address	Item Name	Bit Assignment
43 (L)	Resolution	Bit 7 6 5 4 3 2 1 0 Multiplier 0 0.00001 1 0.0001 1 0 0.001 1 1 0.01 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 (L)	Recog. Char.	ASCII value of custom recognition character
41 (L)	Slope	Bit 7 6 5 4 3 2 1 0 0 Positive slope Channel B 1 Negative slope Channel B 0 Positive slope Channel A 1 Negative slope Channel A
3E (L)	Scale Multiplier	Bits 3-0 = 0-A SCALE1 multiplier Bits 7-4 = 0-A SCALE2 multiplier 0-A: Same multiplier as for Resolution

3D (L)	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
							0			0 to 20mA output
							1			0 to 10V output
						1	0			4 to 20mA output
						1	1			-10V to 10V output
3C (L)	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 (L)	Lockout2	Bit 7	6	5	4	3	2	1	0	
	0 = unlocked								1	Change Item #
	1 = locked							1		CALib
							1			Ser 1, Ser 2, Ser 3
						1				An Lo, An Hi, An SEt
					1					Front Panel meter reset
				1						Front Panel Peak, Latched resets
			1							View alarm setpoints
		1								View Peak locked
35 (L)	Lockout1	Bit 7	6	5	4	3	2	1	0	
	0 = unlocked								1	FiLtEr
	1 = locked							1		Gate t, time out, batch, pulses
							1			SEtuP, ConFiG, display number
						1				InPut
					1					Change Setpoints
				1						SourcE,AL SEt,dEVn1b,1H,2b,2H
			1							SCALE, OFFSEt, Coords, rESoLn
		1								SLOPE, dECPt

34 (L)	Configuration	Bit 7	6	5	4	3	2	1	0	
									0	Enable cutoff of VF totalizing
									1	Totalize all VF values
								0		Linear input
								1		Square Root of input
						0	0			Basic Counter
						0	1			Extended Counter
						1	0			Custom Curve #1 (for FR & VF)
						1	1			Custom Curve #2 (for VF)
										<u>Display mode</u>:
		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, hh.mm.ss
		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 (L)	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
							1	0	0	Peak value only
							1	0	1	All active items + Peak
						0				Term chars end of all items
						1				Term chars end of each item
					0					Non-Latching RTS
					1					Latching RTS
			0	0						Std recognition char, no start/stop char
			0	1						Custom recognition char, no start/stop char
			1	0						Std recognition char, special start/stop char
			1	0						Custom recog char, special start/stop char
		0								Full Duplex
		1								Half Duplex

00 U	Serial Cnfg 4	Bit 7	6	5	4	3	2	1	0	Serial Protocol
								1	0	No Parity
								2	1	Odd Parity
								3	0	Even Parity
						0	0			Custom ASCII protocol (8 bits)
						0	1			Modbus RTU protocol (8 bits)
						1	0			Modbus ASCII protocol (7 bits)
				0	0					1 s Modbus ASCII gap timeout
				0	1					3 s Modbus ASCII gap timeout
				1	0					5 s Modbus ASCII gap timeout
				1	1					10 s Modbus ASCII gap timeout
32 (L)	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 (L)	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
						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
		0								Send unfiltered value
		1								Send filtered value
30 (L)	Options									Do not use. This byte is determined by installed option boards.
2F (L)	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	
						0				Low adaptive threshold	
						1				High adaptive threshold	
					0					Display unfiltered input	
					1					Display filtered input	
				0						Peak value of unfiltered input	
				1						Peak value of filtered input	
			0							Adaptive filter	
			1							Conventional filter	
2E (L)	Setup	Bit 7	6	5	4	3	2	1	0	<u>EXT IN 1</u>	<u>EXT IN 2</u>
						0	0	0	0	Meter Reset	Function Reset
						0	0	1	0	Meter Reset	Peak Display
						0	0	1	1	Meter Reset	External Gate
						0	1	0	0	Function Reset	Hold
						0	1	0	1	Function Reset	Peak Display
						0	1	1	0	Function Reset	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 Reset	Display Blank
						1	0	1	1	Function Reset	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 Coordinates of 2 points	
				0						Scale1, Offset1 entered directly	
				1						Scale1, Offset1 using Coordinates of 2 points	
			0							Blank leading zeros	
			1							Display leading zeros	
		0								Zero the total at power on	
		1								Restore total at power-on	

<table>
<tr><td rowspan="8">2D (L)</td><td rowspan="8">Input Type
(Values in Hex)</td><td colspan="12">Dual Channel Signal Conditioner</td></tr>
<tr><td colspan="3">Rate</td><td colspan="3">Period</td><td colspan="3">Total</td><td colspan="3">Time Interval</td></tr>
<tr><td colspan="3">00 A, B
01 A only
02 Batch
03 A, Atot
05 A, Btot
0B A+B
0C A-B
0D AxB
0E A/B
0F A/B-1</td><td colspan="3">10 A, B
11 A only
1B A+B
1C A-B
1D AxB</td><td colspan="3">20 A, B
21 A only
24 A-B updwn
26 Burst
27 B, Arate
29 A,Bup/dwn
2A A, Binhibit
2B A+B
2C A-B
2D AxB
2E A/B</td><td colspan="3">41 A to B
Stopwatch
50 A to A
51 A to B
52 1/A to A
53 1/A to B
Phase
61 0 to 360
62 -180 /180</td></tr>
<tr><td colspan="12">VF Converter</td></tr>
<tr><td colspan="4">4-20 mA</td><td colspan="4">0-1 mA</td><td colspan="4">0-10V</td></tr>
<tr><td colspan="4">81 A only
82 Batch
83 A, Atotal
88 Atot, A
8F 1/A</td><td colspan="4">91 A only
92 Batch
93 A, Atotal
98 Atot, A
9F 1/A</td><td colspan="4">A1 A only
A2 Batch
A3 A, Atotal
A8 Atot, A
AF 1/A</td></tr>
<tr><td colspan="12">Quadrature</td></tr>
<tr><td colspan="12">C0 Total</td></tr>
<tr><td rowspan="14">0B U</td><td rowspan="14">Alarm Cnfg2</td><td>Bit 7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td colspan="4">#Consecutive readings to Alarm</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>0</td><td>0</td><td>0</td><td colspan="4">1</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>0</td><td>0</td><td>1</td><td colspan="4">2</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>0</td><td>1</td><td>0</td><td colspan="4">4</td></tr>
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<tr><td></td><td></td><td></td><td></td><td></td><td>1</td><td>0</td><td>0</td><td colspan="4">16</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>1</td><td>0</td><td>1</td><td colspan="4">32</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>1</td><td>1</td><td>0</td><td colspan="4">64</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>1</td><td>1</td><td>1</td><td colspan="4">128</td></tr>
<tr><td></td><td></td><td>0</td><td>0</td><td>0</td><td></td><td></td><td></td><td colspan="4">Alarm1 Band Deviation</td></tr>
<tr><td></td><td></td><td>0</td><td>0</td><td>1</td><td></td><td></td><td></td><td colspan="4">Alarm1 Hysteresis</td></tr>
<tr><td></td><td></td><td>0</td><td>1</td><td>0</td><td></td><td></td><td></td><td colspan="4">Alarm2 Band Deviation</td></tr>
<tr><td></td><td></td><td>0</td><td>1</td><td>1</td><td></td><td></td><td></td><td colspan="4">Alarm2 Hysteresis</td></tr>
<tr><td></td><td></td><td>1</td><td>0</td><td>0</td><td></td><td></td><td></td><td colspan="4">No deviation in menu</td></tr>
</table>

0D U	Alarm Cnfg 4	Same as for DPM, page 35
0C U	Alarm Cnfg 3	Same as for DPM, page 35
0A U	Alarm Cnfg 1	Bit 7 6 5 4 3 2 1 0 0 0 0 0 Al1 Hi Active, Al2 Hi Active 0 0 0 1 Al1 Lo Active, Al2 Hi Active 0 0 1 0 Al1 Disabled, Al2 Hi Active 0 1 0 0 Al1 Hi Active, Al2 Lo Active 0 1 0 1 Al1 Lo Active, Al2 Lo Active 0 1 1 0 Al1 Disabled, Al2 Lo Active 1 0 0 0 Al1 Hi Active, Al2 Disabled 1 0 0 1 Al1 Lo Active, 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 Relay1 On when Al1 active, Relay2 On when Al2 active 0 1 Relay1 Off when Al1 active, Relay2 On when Al2 active 1 0 Relay1 On when Al1 active, Relay2 Off when Al2 active 1 1 Relay1 Off when Al1 active, Relay2 Off when Al2 active

11.2 COUNTER / TIMER 2-BYTE RAM DATA TABLE

Hex MS	Hex 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 = 0.01 sec)
38	37	Gatetime	0000 – 4E1F	0 – 19999 Positive magnitude (Units = 0.01 sec)

11.3 COUNTER / TIMER 3-BYTE RAM DATA TABLE

Hex MS	Hex Mid	Hex LS	Name	Stored as
B0 (L)	AF	AE	Deviation2 (values always+) (Hysteresis2)	Values stored as 3-byte 2's complement
AA (L)	A9	A8	Offset2	
9E (L)	9D	9C	Setpoint2	
AD (L)	AC	AB	Deviation1 (values always+) (Hysteresis1)	
A4 (L)	A3	A2	Offset1	
9B (L)	9A	99	Setpoint1	
1B U	1A	19	Deviation4	
18 U	17	16	Deviation3	

15 (U) 12 (U)	14 11	13 10	Setpoint 4 Setpoint 3	
A7 (L) A1 (L)	A6 A0	A5 9F	Scale2 Scale1	Values stored as sign (MS bit) + magnitude (all other bits), fixed DP = 6

11.4 COUNTER / TIMER NON-VOLATILE MEMORY ADDRESSES (2 bytes / address)

<table>
<tr><th></th><th colspan="3">Byte 3</th><th>Byte 2</th><th>Byte 1</th><th></th></tr>
<tr><td>Magnitude (Mag)</td><td colspan="3">XXXX XXXX</td><td>XXXX XXXX</td><td>XXXX XXXX</td><td rowspan="6">S = Sign
Sign = 1 for negative
DP = 1 for DDDDDD.
DP = 6 for D.DDDDD</td></tr>
<tr><td rowspan="2">Sign + Magnitude (S+M)</td><td>X</td><td colspan="2">XXX XXXX</td><td>XXXX XXXX</td><td>XXXX XXXX</td></tr>
<tr><td>S</td><td colspan="4">Magnitude</td></tr>
<tr><td rowspan="2">Sign + DP + Magnitude (S+DP+M)</td><td>X</td><td>XXX</td><td>XXXX</td><td>XXXX XXXX</td><td>XXXX XXXX</td></tr>
<tr><td>S</td><td>DP</td><td colspan="3">Magnitude</td></tr>
<tr><td>2's Complement (2's C)</td><td colspan="3">XXXX XXXX</td><td>XXXX XXXX</td><td>XXXX XXXX</td></tr>
</table>

Hex Addr	MS Byte of NV RAM	Stored As	LS Byte of NV RAM	Stored As
74	Deviation4 Byte 3	Mag	Deviation4 Byte 2	Mag
73	Deviation4 Byte 1	Mag	Deviation3 Byte 3	Mag
72	Deviation3 Byte 2	Mag	Deviation3 Byte 1	Mag
71	Setpoint4 Byte 3	2's C	Setpoint4 Byte 2	2's C
70	Setpoint4 Byte 1	2's C	Setpoint3 Byte 3	2's C
6F	Setpoint3 Byte 2	2's C	Setpoint3 Byte 1	2's C
6E	Alarm Confg4	Bits	Alarm Confg3	Bits
6D	Version (read only)	Byte	M Type (read only)	Byte
6C	T Stop	Byte	T Start	Byte
6B	R Show	Byte	R Skip	Byte
6A	R Stop	Byte	R Start	Byte
35	Analog High2 Byte 3	2's C	Analog High2 Byte 2	2's C
34	Analog High2 Byte 1	2's C	Analog Low2 Byte 3	2's C
33	Analog Low3 Byte 2	2's C	Analog Low2 Byte 1	2's C
32	Serial Confg4	Bits	Modbus Address	Byte
31	Total A Byte 6	Mag	Total A Byte 5	Mag
30	Total A Byte 4	Mag	Total A Byte 3	Mag
2F	Total A Byte 2	Mag	Total A Byte 1	Mag
2E	Total B Byte 6	Mag	Total B Byte 5	Mag
2D	Total B Byte 4	Mag	Total B Byte 3	Mag
2C	Total B Byte 2	Mag	Total B Byte 1	Mag
2A	Do not use	---	Analog Type	Bits

29	Cutoff Byte 2	Mag	Cutoff Byte 1	Mag
28	Recog Character	Byte	System Decimal Point	Bits
27	Do not use	Bits	Resolution	Bits
26	Display Item	Bits	Slope	Bits
25	Pulses Byte 2	Mag	Pulses Byte 1	Mag
24	Scale Multiplier	Bits	Analog Output Setup	Bits
23	Source	Bits	Batch	Bits
22	Timeout Byte 2	Mag	Timeout Byte 1	Mag
21	Gate Time Byte 2	Mag	Gate Time Byte 1	Mag
20	Lockout2	Bits	Lockout1	Bits
1F	Config	Bits	Serial Config3	Bits
1E	Serial Config2	Bits	Serial Config1	Bits
1D	Options	Bits	Filter	Bits
1C	Setup	Bits	Input Type	Bits
1B	Alarm Config 2	Bits	Alarm Config1	Bits
1A	Analog High Byte 3	2’s C	Analog High Byte 2	2’s C
19	Analog High Byte 1	2’s C	Analog Low Byte 3	2’s C
18	Analog Low Byte 2	2’s C	Analog Low Byte 1	2’s C
17	Deviation 2 Byte 3	Mag	Deviation2 Byte 2	Mag
16	Deviation 2 Byte 1	Mag	Deviation1 Byte 3	Mag
15	Deviation 1 Byte 2	Mag	Deviation1 Byte 1	Mag
14	Offset2 Byte 3	2’s C	Offset2 Byte 2	2’s C
13	Offset2 Byte 1	2’s C	Scale2 Byte 3	S+M
12	Scale2 Byte 2	S+M	Scale2 Byte 1	S+M
11	Offset1 Byte 3	2’s C	Offset1 Byte 2	2’s C
10	Offset1 Byte 1	2’s C	Scale1 Byte 3	S+M
0F	Scale1 Byte 2	S+M	Scale1 Byte 1	S+M
0E	Setpoint2 Byte 3	2’s C	Setpoint2 Byte 2	2’s C
0D	Setpoint2 Byte 1	2’s C	Setpoint1 Byte 3	2’s C
0C	Setpoint1 Byte 2	2’s C	Setpoint1 Byte 1	2’s C
0B	High Read2 Byte 3	2’s C	High Read2 Byte 2	2’s C
0A	High Read2 Byte 1	2’s C	High In2 Byte 3	S+DP+M
09	High In2 Byte 2	S+DP+M	High In2 Byte 1	S+DP+M
08	Low Read2 Byte 3	2’s C	Low Read2 Byte 2	2’s C
07	Low Read2 Byte 1	2’s C	Low In2 Byte 3	S+DP+M
06	Low In2 Byte 2	S+DP+M	Low In2 Byte 1	S+DP+M
05	High Read1 Byte 3	2’s C	High Read1 Byte 2	2’s C
04	High Read1 Byte 1	2’s C	High In1 Byte 3	S+DP+M
03	High In1 Byte 2	S+DP+M	High In1 Byte 1	S+DP+M
02	Low Read1 Byte 3	2’s C	Low Read1 Byte 2	2’s C
01	Low Read1 Byte 1	2’s C	Low In1 Byte 3	S+DP+M
00	Low In1 Byte 2	S+DP+M	Low In1 Byte 1	S+DP+M

12. APPENDIX C: WEIGHT METER MEMORY ADDRESSES AND DATA DEFINITIONS

12.1 WEIGHT METER 1-BYTE RAM MEMORY DATA

(L) = Lower memory, (U) = Upper memory

The bit assignments below constitute an 8-digit binary number, which needs to be converted to Hex using a program such a Scientific Calculator under MS Windows Accessories. To change an Item in Counter / Timer RAM Memory, write the converted Hex value to the Hex Address shown in the left column. To change an Item in Nonvolatile Memory, go to table 11.3, read the existing two-byte word (MS byte and LS byte) from the Counter / Timer for the Hex Address which includes the Item to be changed, edit the MS or LS byte as appropriate, and write the edited word back to the Hex Address.

Hex Address	Item Name	Bit Assignment										
2D (L)	Setup	Bit 7	6	5	4	3	2	1	0	EXT IN A	EXT IN B	BOTH
						0	0	0	0	Meter Reset	Meter Hold	Cold
						0	0	0	1	Funct Reset	Peak Disp	Cold
						0	0	1	0	Meter Hold	Peak Disp	Func
						0	0	1	1	Meter Hold	Tare	Tare
						0	1	0	0	Peak Disp	Tare	Func
						0	1	0	1	Meter Reset	Tare	Cold
						0	1	1	0	Funct Reset	Tare	Cold
						0	1	1	1	Tare Reset	Tare	Cold
						1	0	0	0	Disp Blank	Tare	Cold
						1	0	0	1	Meter Reset	Disp Blank	Cold
						1	0	1	0	Funct Reset	Disp Blank	Cold
						1	0	1	1	Disp Item	Tare	Tare
						1	1	0	0	Disp Item	Disp Blank	Func
						1	1	0	1	Meter Reset	Disp Item	Cold
						1	1	1	0	Funct Reset	Disp Item	Cold
						1	1	1	1	Meter Hold	Disp Item	Cold
					0					Scale Using Scale, Offset		
					1					Scale Coord of 2 Points Method		
				0						Peak Key Action Displays Peak		
				1						Peak Key Action Displays Tare		
			0							Noise Cancellation for 60 Hz		
			1							Noise Cancellation for 50 Hz		
		0								4-1/2 Digits, No Dummy Zero		
		1								4-1/2 Digits Plus Dummy Zero		

6B (L)	Config	Bit 7	6	5	4	3	2	1	0			
									0	Enable Adaptive Filtering		
									1	Disable Adaptive Filtering		
								0		Peak of Net Value		
								1		Peak of Gross Value		
							0			Enable Dribble		
							1			Disable Dribble		
						0				Setup Scale Method		
						1				Reading 2 Coordinates Method		
					0					Allow Negative Readings		
					1					Disallow Negative Readings		
6D (L)	Count	Bit 7	6	5	4	3	2	1	0			
						0	0	0	0	No Auto-Zero		
						0	0	0	1	±1 Auto-Zero		
						0	0	1	0	±2 Auto-Zero		
						0	0	1	1	±3 Auto-Zero		
						0	1	0	0	±4 Auto-Zero		
						0	1	0	1	±5 Auto-Zero		
						0	1	1	0	±6 Auto-Zero		
						0	1	1	1	±7 Auto-Zero		
						1	0	0	0	±8 Auto-Zero		
						1	0	0	1	±9 Auto-Zero		
		0	0	0	0					Count by 1		
		0	0	0	1					Count by 2		
		0	0	1	0					Count by 5		
		0	0	1	1					Count by 10		
		0	1	0	0					Count by 20		
		0	1	0	1					Count by 50		
		0	1	1	0					Count by 100		
		0	1	1	1					Count by 200		
		1	0	0	0					Count by 500		
		1	0	0	1					Count by 1000		
2F (L)	Filter	Bit 7	6	5	4	3	2	1	0			
						0	0	0	0	Auto Filter		
						0	0	0	1	Batch Filter (16 Samples)		
										Time constant	60 Hz	50 Hz
						0	0	1	0	Moving Average	0.07s	0.085s
						0	0	1	1	Moving Average	0.14	0.17
						0	1	0	0	Moving Average	0.28	0.34
						0	1	0	1	Moving Average	0.57	0.68
						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	10.9
							1	0	1	0	Moving Average	18.1	21.8
							1	0	1	1	Moving Average	36.2	43.5
							1	1	0	0	Moving Average	72.5	87.0
							1	1	0	1	Moving Average	145	174
							1	1	1	0	Moving Average	290	348
							1	1	1	1	Unfiltered (Used with Hold)		
						0					Low adaptive threshold		
						1					High adaptive threshold		
					0						Display value of 16-reading batch		
					1						Display value of filtered signal		
				0							Take peak of unfiltered signal		
				1							Take peak of filtered signal		
			0								Alarm from unfiltered signal		
			1								Alarm from filtered signal		
35 (L)	Decimal Point	Bit	7	6	5	4	3	2	1	0	<u>Meter Display</u>		
								0	0	1	XXXXX. (dec point not displayed)		
								0	1	0	XXXX.X		
								0	1	1	XXX.XX		
								1	0	0	XX.XXX		
								1	0	1	X.XXXX		
								1	1	0	.XXXXX		
0A (U)	Alarm Confg1	Bit	7	6	5	4	3	2	1	0			
							0	0	0	0	Al1 Hi active, Al2 Hi active		
							0	0	0	1	Al1 Lo active, Al2 Hi active		
							0	0	1	0	Al1 Disabled, Al2 Hi active		
							0	1	0	0	Al1 Hi active, Al2 Lo active		
							0	1	0	1	Al1 Lo active, Al2 Lo active		
							0	1	1	0	Al1 disabled, Al2 Lo active		
							1	0	0	0	Al1 Hi active, Al2 disabled		
							1	0	0	1	Al1 Lo active, Al2 disabled		
							1	0	1	0	Al1 disabled, Al2 disabled		
					0	0					Al1 & Al2 non-latching		
					0	1					Al1 latching, Al2 non-latching		
					1	0					Al1 non-latching, Al2 latching		
					1	1					Al1 & Al2 latching		
			0	0							Relay1 On when Al1 active, Relay2 On when Al2 active		
			0	1							Relay1 Off when Al1 active, Relay2 On when Al2 active		
			1	0							Relay1 On when Al1 active, Relay2 Off when Al2 active		

			1	1							Relay1 Off when AI1 active, Relay2 Off when AI2 active	
0B (U)	Alarm Confg2	Bit	7	6	5	4	3	2	1	0	<u>Alarm Trigger Delay</u>	
											<u>60 Hz</u>	<u>50Hz</u>
								0	0	0	0.018s	0.021s
								0	0	1	0.035	0.043
								0	1	0	0.07	0.085
								0	1	1	0.14	0.17
								1	0	0	0.28	0.34
								1	0	1	0.56	0.68
								1	1	0	1.13	1.36
								1	1	1	2.27	2.72
											<u>Alarm Comparison</u>	
						0	0				AI1 Net, AI2 Net	
						0	1				AI1 Gross, AI2 Net	
						1	0				AI1 Net, AI2 Gross	
						1	1				AI1 Gross, AI2 Gross	
0D (U)	Alarm Cnfg 4	Same as for DPM, page 35										
0C (U)	Alarm Cnfg 3	Same as for DPM, page 35										
BF (L)	Analog Output Setup	Bit	7	6	5	4	3	2	1	0		
									0	0	Filtered Net	
									0	1	Filtered Gross	
									1	0	Unfiltered Net	
									1	1	Unfiltered Gross	
							0	0			Current Output (0-20 mA)	
							0	1			Voltage Output (0-10V)	
							1	0			Current Output (4-20 mA)	
							1	1			Voltage Output (-10 to +10V)	
31 (L)	Serial Cnfg1	Bit	7	6	5	4	3	2	1	0	<u>Continuous Output Data Rate</u>	
											<u>60 Hz</u>	<u>50 Hz</u>
							0	0	0	0	0.017s	0.020s
							0	0	0	1	0.28	0.34
							0	0	1	0	0.57	0.68
							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	1:13	1:27

			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
		0								Send Unfiltered Value
		1								Send Filtered Value
32 (L)	Serial Cnfg2	Bit 7	6	5	4	3	2	1	0	
					X	X	X	X	X	Binary Custom ASCII addr. 0-31
				0						Continuous Mode
				1						Command Mode
			0							Alarm data not included with rdg.
			1							Alarm data included with rdg.
		0								No <LF> Following <CR>)
		1								<LF> Following <CR>
6A (L)	Serial Cnfg3	Bit 7	6	5	4	3	2	1	0	<u>Data Sent:</u>
							0	0	0	Net + Gross
							0	0	1	Net Only
							0	1	0	Gross Only
							0	1	1	Peak Only (Net or Gross)
							1	0	0	Net + Gross + Peak
						0				<CR> or <CR><LF> at end of all Items
						1				<CR> or <CR><LF> at end of each Item (if no Alarm character)
					0					Non-latching RTS
					1					Latching RTS
				0						Normal Cont Serial TX
				1						Special Start, Stop Characters
			0							Full Duplex
			1							Half Duplex
00 (U)	Serial Cnfg4	Bit 7	6	5	4	3	2	1	0	<u>Serial Protocol</u>
								0	0	No Parity
								0	1	Odd Parity
								1	0	Even Parity
						0	0			Laurel ASCII (8 Bits, No Parity)
						0	1			Modbus RTU Protocol (8 Bits)
						1	0			Modbus ASCII Protocol (7 bits)
				0	0					1 s Modbus ASCII Gap Timeout

					0	1					3 s Modbus ASCII Gap Timeout
					1	0					5 s Modbus ASCII Gap Timeout
					1	1					10 s Modbus ASCII Gap Timeout
33 (L)	Lockout1	Bit	7	6	5	4	3	2	1	0	<u>Front Panel Setup Menu Item</u>
	0 = Enabled									1	Count
	1 = Disabled								1		Setup, Cnfg, dEC.Pt
								1			Input Type
							1				Change Displayed Item #
						1					Tare
					1						Offset, Lo read, Hi read
				1							Scale, Lo input, Hi input
			1								Filter
34 (L)	Lockout2	Bit	7	6	5	4	3	2	1	0	<u>Front Panel Setup Menu Item</u>
	0 = Enabled									1	Serial Comm Config
	1 = Disabled								1		Analog Output Scaling
								1			Alarm Setpoint Programming
							1				Alarm Config
						1					Front Panel Meter Reset
					1						Front Panel Function Reset
				1							View Alarm Setpoints
			1								View Peak Value

12.3 WEIGHT METER 3-BYTE RAM MEMORY DATA (3 Bytes / Item)

All numeric values except scale factor utilize a 2's complement, 3-byte Hex format, where the MS byte, Mid byte and LS byte each consist of two Hex nibbles: XX XX XX.

Polarity and decimal point for scale are set by the most significant Hex nibble of the most significant byte (leftmost byte) as follows:

MS Bit	Polarity & Dec Pt
1	XXXXX.
2	XXXX.X
3	XXX.XX
4	XX.XXX
5	X.XXXX
6	.XXXXX
9	- XXXXX.
A	- XXXX.X
B	- XXX.XX
C	- XX.XXX
D	- X.XXXX
E	- .XXXXX

Hex addresses for numeric values are also in the 3-byte Hex format, as explained in 12.1, as follows:

Numeric Value	MS Byte	Mid Byte	LS Byte
Analog high value	A1 (L)	A0	9F
Analog low value	9E (L)	9D	9C
Setpoint 2 Diff	9B (L)	9A	99
Setpoint 1 Diff	98 (L)	97	96
Offset value	8F (L)	8E	8D
Scale factor	8C (L)	8B	8A
Setpoint4	15 (U)	14	13
Setpoint3	12 (U)	11	10
Setpoint2	89 (L)	88	87
Setpoint1	86 (L)	85	84
Tare value	E3 (L)	E2	E1

12.4 WEIGHT METER NONVOLATILE MEMORY HEX ADDRESSES (2 Bytes / Address)

Please see the 1 Byte RAM Data Table for bit definitions.

Hex Address	MS Byte	LS Byte
1D	Tare3	Tare2
1C	Tare1	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	Signal Conditioner 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	Setpoint 1 2	Setpoint1 1
35	Serial Cnfg 4	Modbus Address
36	Spare	Analog Output Type

13. RECOMMENDED CONVERTER SUPPLIER

B & B Electronics Manufacturing Co.

707 Dayton Road, Ottawa, IL 61350. Phone: (815) 433-5100, Fax: (815) 433-5109, Website: www.bb-elec.com. B & B offers a variety of RS485-to-RS232 converters, RS232-to-RS485 converters, RS485-to-USB converters, and RJ11 to 9-pin adapters. B & B Model 485OT9L is the recommended RS485-to-RS232 converter for use with products covered in this manual.

WARRANTY

Yokogawa Corporation of America 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 Yokogawa 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. Yokogawa specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

EXCLUSIVE REMEDIES

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