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MODEL CUB5COM -SERIAL COMMUNICATIONS PLUG-IN OPTION CARDS

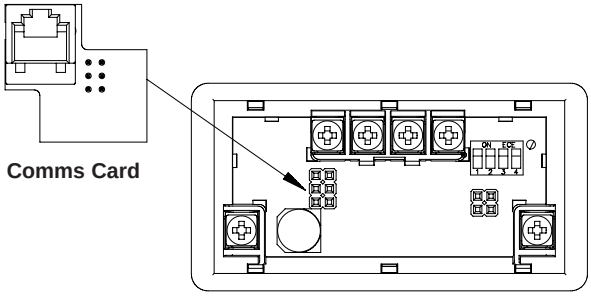
DESCRIPTION

This bulletin serves as a guide for the installation, configuration and operation of the RS232 and RS485 serial communications plug-in cards for the CUB5. The plug-in cards are separately purchased option cards that plug into the main circuit board of the meter. Only one communication card can be used at a time.

Crimson is a Windows® based program that allows configuration of the CUB5 meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the CUB5 meter. The CUB5 program can then be saved in a PC file for future use. A CUB5 serial plug-in card is required to program the meter using the software.

INSTALLING PLUG-IN CARDS

The cards plug into the main circuit board of the meter as shown.



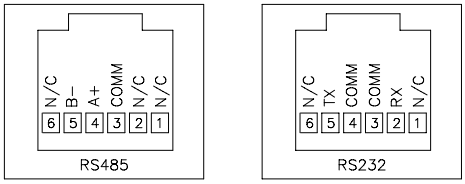
WARNING: Disconnect all power to the unit before installing Plug-in card.

CAUTION: The Plug-in cards and main circuit board contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.

WIRING CONNECTIONS

Connections to the serial communications cards are made through an RJ11 modular connector. Connector pin-outs for the RS485 and RS232 cards are shown below.

RJ11 CONNECTOR PIN OUTS



SPECIFICATIONS

RS485 SERIAL COMMUNICATIONS CARD

Type: RS485 multi-point balanced interface (non-isolated)
Baud Rate: 300 to 19.2k
Data Format: 7/8 bits; odd, even, or no parity
Bus Address: 0 to 99; max 32 meters per line
Transmit Delay: Selectable, 2 msec min. or 50 msec min.

RS232 SERIAL COMMUNICATIONS CARD

Type: RS232 half duplex (non-isolated)
Baud Rate: 300 to 19.2k
Data Format: 7/8 bits; odd, even, or no parity

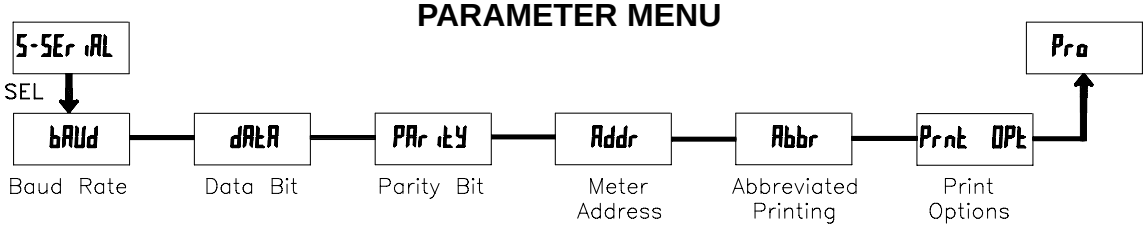
ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
CUB5COM	RS485 Serial Communications Card	CUB5COM1
	RS232 Serial Communications Card	CUB5COM2
SFCRD*	Crimson 2 PC Configuration Software for Windows 98, ME, 2000 and XP	SFCRD200

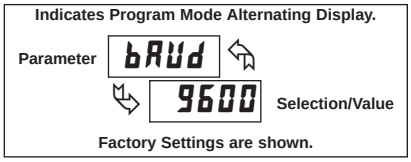
* Crimson software is available for download from http://www.redlion.net/

MODULE 5 - SERIAL COMMUNICATIONS PARAMETERS (5-SEriAL)

PARAMETER MENU



Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the CUB5 with those of the host computer or other serial device. The Serial Setup Parameters are only accessible when an optional RS232 or RS485 serial communications module is installed in the meter.



BAUD RATE

300 600 1200 2400 4800 9600 19200

Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting and receiving.

DATA BIT

7-bit 8-bit

Select either 7- or 8-bit data word length. Set the word length to match the other serial communications equipment on the serial link.

PARITY BIT

NO Odd EVEN

This parameter only appears when the Data Bit parameter is set to a 7-bit data word length. Set the parity bit to match that of the other serial equipment on the serial link. The meter ignores parity when receiving data and sets the parity bit for outgoing data. If parity is set to NO, an additional stop bit is used to force the frame size to 10 bits.

METER ADDRESS

0 to 99

Enter the serial node address. With a single unit, an address is not needed and a value of zero can be used (RS232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS485 applications.

ABBREVIATED PRINTING

NO YES

This parameter determines the formatting of data transmitted from the meter in response to a Transmit Value command or a Block Print Request. Select NO for a full print transmission, consisting of the meter address, mnemonics, and parameter data. Select YES for abbreviated print transmissions, consisting of the parameter data only. This setting is applied to all the parameters selected in the PRINT OPTIONS. (Note: If the meter address is 0, the address will not be sent during a full transmission.)

PRINT OPTIONS

NO YES

This parameter selects the meter values transmitted in response to a Print Request. A print request is also referred to as a block print because more than one parameter can be sent to a printer or computer as a block.

Selecting YES displays a sublist for choosing the meter parameters to appear in the print block. All active parameters entered as YES in the sublist will be transmitted during a block print. Parameters entered as NO will not be sent.

The "Print All" (Prnt ALL) option selects all meter values for transmitting (YES), without having to individually select each parameter in the sublist.

Note: Inactive parameters will not be sent regardless of the print option setting. For example, Counter B or Scale Factor B will only be sent when the CUB 5 is programmed for Dual Counter mode. In any other count mode, these parameters are inactive and will not be transmitted. Likewise, the Setpoint value will not be sent unless an optional setpoint card is installed in the meter.

DISPLAY	DESCRIPTION	FACTORY SETTING	MNEMONIC
Count A	Counter A	YES	CTA
Count b	Counter B	NO	CTB
rAtE	Rate Value	NO	RTE
CntA ScF	Scale Factor A	NO	SFA
Cntb ScF	Scale Factor B	NO	SFB
SEtPt	Setpoint	NO	SPT

Sending Serial Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a command terminator character, * or $.

Command Chart

Command	Description	Notes
N	Node (meter) Address Specifier	Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.
T	Transmit Value (read)	Read a register from the meter. Must be followed by a register ID character.
V	Value Change (write)	Write to register of the meter. Must be followed by a register ID character and numeric data.
R	Reset	Reset a count value or the output. Must be followed by a register ID character
P	Block Print Request (read)	Initiates a block print output. Registers in the print block are selected in Print Options.

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints all the active selections chosen in the Print Options menu parameter.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See timing diagram figure for differences in meter response time when using the * and $ terminating characters.

Register Identification Chart

ID	Value Description	MNEMONIC	Applicable Commands	Transmit Details (T and V)
A	Counter A	CTA	T, V, R	8 digit positive/7 digit negative (with minus sign)
B	Counter B	CTB	T, V, R	7 digit, positive only
C	Rate	RTE	T	6 digit, positive only
D	Scale Factor A	SFA	T, V	6 digit, positive only
E	Scale Factor B	SFB	T, V,	6 digit, positive only
F	Setpoint (Reset Output)	SPT	T, V, R	per setpoint Assignment, same as Counter A or Rate

Command String Examples:

1. Node address = 17, Write 350 to the Setpoint value
   String: N17VF350$
2. Node address = 5, Read Counter A, response time of 50 msec min
   String: N5TA*
3. Node address = 0, Reset Setpoint output
   String: RF*
4. Node address = 31, Request a Block Print Output, response time of 2 msec min
   String: N31P$

Transmitting Data to the Meter

Numeric data sent to the meter must be limited to transmit details listed in the Register Identification Chart. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution. (For example: The meter's scaled decimal point position is set for 0.0 and 25 is written to a register. The value of the register is now 2.5. In this case, write a value of 250 to equal 25.0).

Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.

Receiving Data From The Meter

Data is transmitted from the meter in response to either a transmit command (T), a block print request command (P) or a User Input print request. The response from the meter is either a full field transmission or an abbreviated transmission, depending on the selection chosen in Module 5.

Full Field Transmission

Byte	Description
1, 2	2 byte Node Address field [00-99]
3	<SP> (Space)
4-6	3 byte Register Mnemonic field
7-18	12 byte data field; 10 bytes for number, one byte for sign, one byte for decimal point
19	<CR> (carriage return)
20	<LF> (line feed)
21	<SP>* (Space)
22	<CR>* (carriage return)
23	<LF>* (line feed)

** These characters only appear in the last line of a block print.*

The first two characters transmitted are the meter address. If the address assigned is 0, two spaces are substituted. A space follows the meter address field. The next three characters are the register mnemonic, as shown in the Register Identification Chart.

The numeric data is transmitted next. The numeric field (bytes 7 to 18) is 12 characters long. When a requested counter or rate value exceeds the meter's display limits, an * (used as an overflow character) replaces a space in byte 7. Byte 8 is always a space.

The remaining ten positions of this field consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with a <CR> and <LF>. After the last line of a block print, an extra <SP>, <CR> and <LF> are added to provide separation between the print blocks.

Abbreviated Transmission

Byte	Description
1-12	12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point
13	<CR> (carriage return)
14	<LF> (line feed)
15	<SP>* (Space)
16	<CR>* (carriage return)
17	<LF>* (line feed)

** These characters only appear in the last line of a block print.*

The abbreviated response suppresses the node address and register ID, leaving only the numeric part of the response.

Meter Response Examples:

1. Node address = 17, full field response, Counter A = 875
   17 CTA 875 <CR><LF>
2. Node address = 0, full field response, Setpoint = -250.5
   SPT -250.5<CR><LF>
3. Node address = 0, abbreviated response, Setpoint = 250, last line of block print
   250<CR><LF><SP><CR><LF>

Command Response Time

The meter can only receive data or transmit data at any one time (half-duplex operation). During RS232 transmissions, the meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.

At the start of the time interval t_1, the computer program prints or writes the string to the com port, thus initiating a transmission. During t_1, the command characters are under transmission and at the end of this period, the command terminating character (* or $) is received by the meter. The time duration of t_1 is dependent on the number of characters and baud rate of the channel.

t_1 = (10 times the # of characters) / baud rate

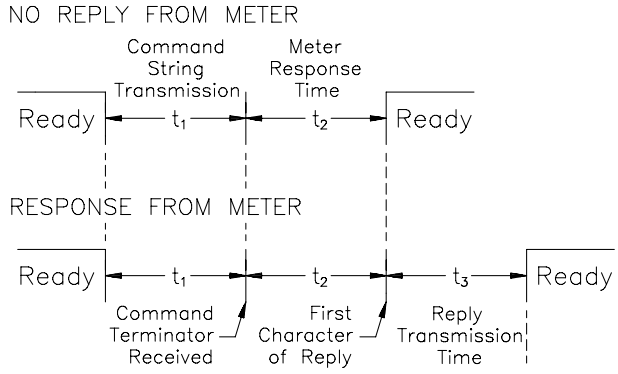
At the start of time interval t_2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t_2 varies. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval t_2 is controlled by the use of the command terminating character. The '*' terminating character results in a response time of 50 msec. minimum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with '$' results in a response time (t_2) of 2 msec. minimum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received.

At the beginning of time interval t_3, the meter responds with the first character of the reply. As with t_1, the time duration of t_3 is dependent on the number of characters and baud rate of the channel. At the end of t_3, the meter is ready to receive the next command.

t_3 = (10 times the # of characters) / baud rate

The maximum serial throughput of the meter is limited to the sum of the times t_1, t_2 and t_3.



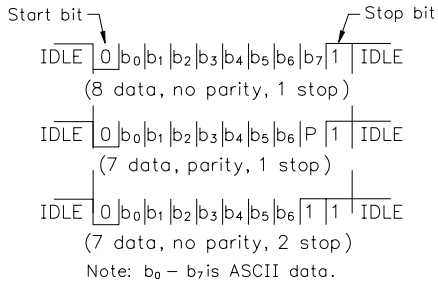
Timing Diagram Figure

Communication Format

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character. The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

LOGIC	INTERFACE STATE	RS232*	RS485*
1	mark (idle)	TXD,RXD; -3 to -15 V	a-b < -200 mV
0	space (active)	TXD,RXD; +3 to +15 V	a-b > +200 mV
* Voltage levels at the Receiver			

Data is transmitted one byte at a time with a variable idle period between characters (0 to ∞). Each ASCII character is "framed" with a beginning start bit, an optional parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.



Character Frame Figure

Start Bit and Data Bits

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted.

Parity Bit

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The CUB5 meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop Bit

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit. If 7 data bits and no parity is selected, then 2 stop bits are sent from the meter.

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