User's Guide

DP6-COM
Serial Communication Card

LP0695A

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 DP63000x. 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.

DP6-SOFT is a Windows® based program that allows configuration of the DP63000x meter from a PC. This software offers standard drop-down menu commands, that make it easy to program the DP63000x meter. The DP63000x program can then be saved in a PC file for future use. A DP63000x 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.

Comms Card
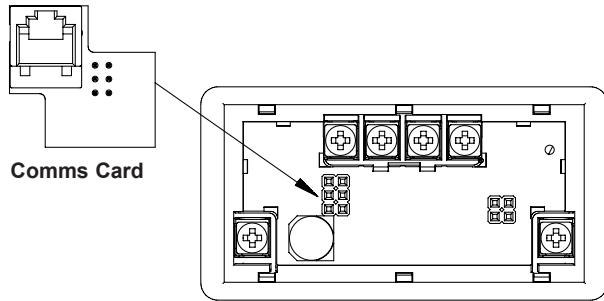
⚡ **WARNING: Disconnect all power to the unit before installing Plug-in card.**

⚠ **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
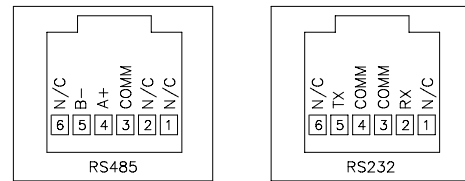
SPECIFICATIONS

RS485 SERIAL COMMUNICATIONS CARD
  Type: RS485 multi-point balanced interface (non-isolated)
  Baud Rate: 300 to 38.4k
  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 38.4k
  Data Format: 7/8 bits; odd, even, or no parity

MODULE 5 - SERIAL COMMUNICATIONS PARAMETERS (5-5Er iAL)

PARAMETER MENU

5-5Er iAL							Pro

SEL ↓

bAUd	dAtA	PAr itY	Addr	Abbr	Prnt OPt
Baud Rate	Data Bit	Parity Bit	Meter Address	Abbreviated Printing	Print Options
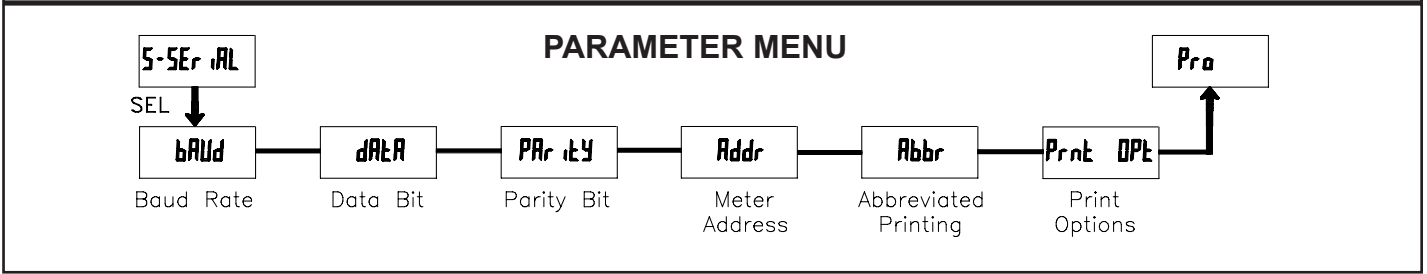
Module 5 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the DP63000x with those of the host computer or other serial device. The Serial Setup Parameters are only accessible when an optional RS232 or RS485 serial communications module is installed in the meter.

Indicates Program Mode Alternating Display.

Parameter **bAUd** ⇪
⇩ **9600** Selection/Value

Factory Settings are shown.

BAUD RATE

bAUd ⇪
⇩ 9600

| 300 | 1200 | 4800 | 19200 |
| 600 | 2400 | 9600 | 38400 |

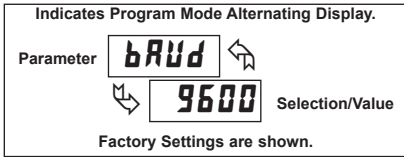Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting and receiving.

DATA BIT

dAtA ⇪
⇩ 7-b it

7-b it   8-b it

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

PAr itY ⇪
⇩ Odd

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

Addr ⇪
⇩ 00

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

Abbr ⇪
⇩ NO

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

Prnt OPt ⇪
⇩ NO

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. Likewise, the Setpoint value will not be sent unless an optional setpoint card is installed in the meter.

ANALOG MODELS

DISPLAY	DESCRIPTION	FACTORY SETTING	MNEMONIC
INP	Input	YES	INP
HI	Maximum	NO	MAX
LO	Minimum	NO	MIN
SPt-1	Setpoint 1	NO	SP1
SPt-2	Setpoint 2	NO	SP2

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 register value or setpoint 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 Command Response Time section 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	Input	INP	T	5 digit
B	Maximum	MAX	T, R	5 digit
C	Minimum	MIN	T, R	5 digit
D	Setpoint 1	SP1	T, R, V	5 digit positive/4 digit negative
E	Setpoint 2	SP2	T, R, V,	5 digit positive/4 digit negative

Command String Examples:

1. Node address = 17, Write 350 to the Setpoint value
   String: N17VD350$
2. Node address = 5, Read Input, response time of 50 msec min
   String: N5TA*
3. Node address = 0, Reset Setpoint output
   String: RE*
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
7-15	9 byte data field; 7 bytes for number, one byte for sign, one byte for decimal point
16	<CR> (carriage return)
17	<LF> (line feed)
18	<SP>* (Space)
19	<CR>* (carriage return)
20	<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 15) is 9 characters long. When a requested display value exceeds the meter's display limits, decimal points are sent in place of numerical data to indicate a display overrange.

The remaining 7 positions of this field consist of a minus sign (for negative values), a floating decimal point (if applicable), and five positions for the

requested value. The data within bytes 9 to 15 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
1-9	9 byte data field, 7 bytes for number, one byte for sign, one byte for decimal point
10	<CR> (carriage return)
11	<LF> (line feed)
12	<SP>* (Space)
13	<CR>* (carriage return)
14	<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, Input = 875
   17 INP   875 <CR><LF>

2. Node address = 0, full field response, Setpoint = -250.5
   SP1   -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.

$$t_1 = (10 \text{ times the \# of characters}) / \text{baud rate}$$

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.

$$t_3 = (10 \text{ times the \# of characters}) / \text{baud rate}$$

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
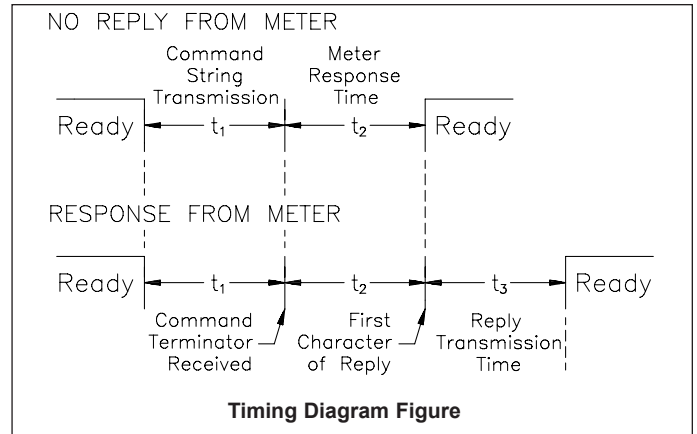
Communication Format

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
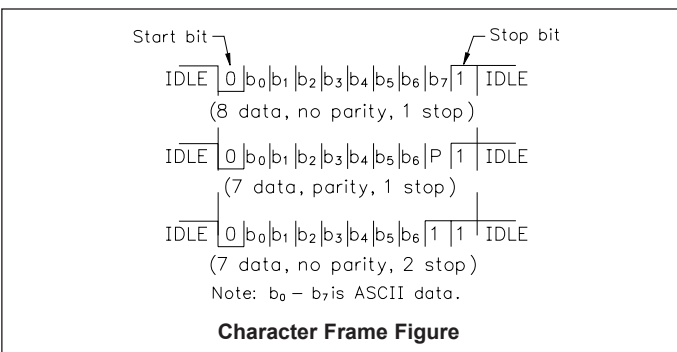
Start Bit and Data Bits

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 DP63000x 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.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **25 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **two (2) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:
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2. Model and serial number of the product, and
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