



VP Process Inc.

Model: VP-EC-RDU
Modbus RTU
LCD Display



User Manual

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VP-EC-RDU Modbus RTU LCD Display

Standard Features

- Low Power (12 - 24 VDC)
2.1 x 5mm Barrel Plug, RJ45 and Terminal Block Input
- On-Board Local Temperature Sensor
10K Thermistor
- RS-485 MODBUS RTU Protocol
- Programmable Baud Rates
9.6, 19.2, 57.6 and 115.2K
- Programmable Modbus ID
1 thru 253
- Large LCD Display
4 Line x 20 Character
White Letters, Blue Background
Programmable Contrast Adjustment
76.0 x 25.2mm Viewing Area
- User Interface
Password Protection
2 Status Tri-Colour Alarm LEDs
Blue Power On LED
4 Pushbuttons: Menu, Enter, Up, Down
Audible
- Enclosure with Mounting Tabs
6" Wide x 4" High x 1.5" Deep
- Modbus Functions:
03 Read Hold Registers
16 Write Holding Registers
- Simple To Implement
Write ASCII Characters to
Holding Registers using
Modbus Function 16



VP-EC-RDU
Modbus RTU LCD Display

The VP-EC-RDU LCD Display is the perfect addition to any embedded controls system that uses the MODBUS protocol and has an RS485 port. The easy to read 4 line x 20 character display is simple to use. Just write ASCII characters to the applicable holding registers, along with the status LEDs and Audible, and the VP-EC-RDU does the rest.

Each Status LED can be programmed Green, Amber, Red or Off with Solid, Slow Flash or Fast Flash operation. This is perfect for alarm indication in PLC applications. The four user buttons can be read and programmed for different functions as required by the user's application. The local Temperature Sensor located on the main PCB can be read by Modbus Function 03, or can be simply displayed on the LCD.

The user interface is password protected (4 digit PIN). Once entered, the user can select by using the Up, Down and Enter pushbuttons:

- Program Modbus ID 1 thru 253
- Program Baud Rate (9.6, 19.2, 57.6, 115.2K)
- Adjust LCD Contrast
- Program LCD Backlight Enable
- Status LED Test
- Audible Enable
- Program Menu Reset Time
- Program New Password



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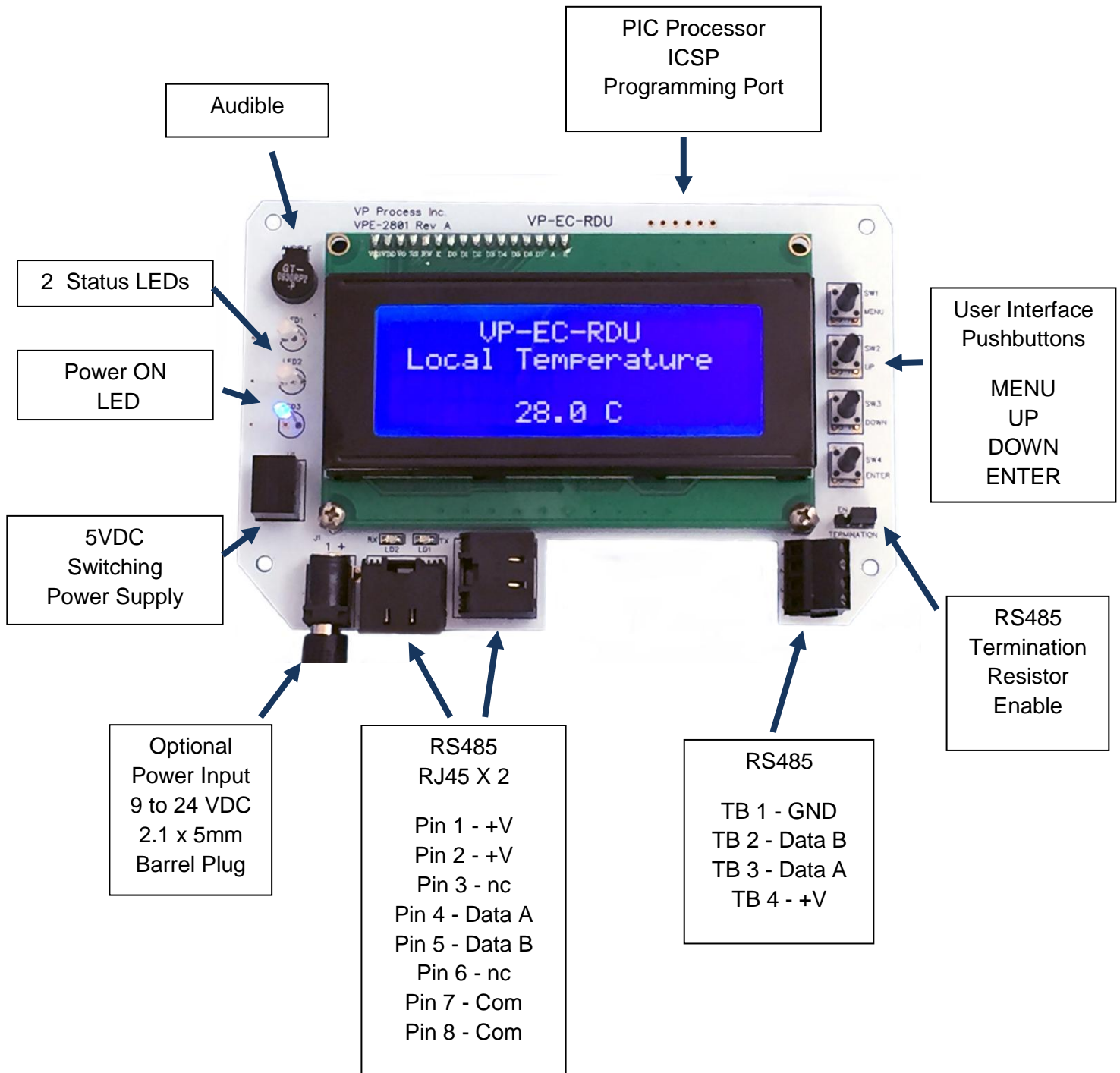
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1. GENERAL SPECIFICATIONS

Power Input:	24 VDC Nominal (9 –28 VDC), 45 mA Average @ 24 VDC 2.1 x 5 mm Barrel Plug or Terminal Block
RS485:	RS485 2 wire, Half Duplex, Data A, Data B Protocol N,8,1 Programmable Baud Rates (9.6, 19.2, 57.4, 115.2 K) RS485 LED's: TX (Amber), RX (Green) located on main PCB
LCD Display:	20 Character x 4 Lines Type: STN-LCD Blue White Letters on Blue Background
Terminations:	4 Point Terminal Block and 2 RJ45 Connectors
Temperature Sensor:	Located on the main printed circuit board 10K Thermistor, 3380 Beta Range: -20 to +70 °C (Steinhart-Hart Equation)
Operating Temperature:	-20 Deg °C to +70 °C Operating Temperature
Storage Temperature:	-40 Deg °C to +85 °C Storage Temperature
User Interface:	Four Pushbuttons: MENU, UP, DOWN, ENTER 2 Status LEDs: Programmable RED, GREEN, AMBER LED Status: Programmable OFF, SOLID, SLOW FLASH and FAST FLASH Programmable from Modbus Interface BLUE Power ON LED
Audible:	Key Click and Programmable ON or OFF from Menu Programmable from Modbus Interface
Enclosure:	Dimensions: 6.0" (W) x 4.0" (H) x 1.13" (D) Material: Flame Retardant ABS Flame Rating: ULV94V-0 Colour: Black
Menu Operation:	Press UP, DOWN and ENTER Simultaneously Standard Menu Displays: <ul style="list-style-type: none">• Display Modbus ID• Display RS485 Baud Rate• Display Local Temperature• Display Software Version• Enter "Setup Program" - Password Required Program Menu Displays: <ul style="list-style-type: none">▪ Program Modbus ID▪ Program RS485 Baud Rates▪ Adjust and save LCD Contrast▪ LCD Backlight Enable▪ Status LED Test▪ Audible Enable▪ Program Menu Reset Time▪ Program New Password

2. FIELD CONNECTIONS





3. BASIC OPERATION

PUSHBUTTON OPERATION

There are three pushbuttons, UP, ENTER and DOWN. The basic operation is UP or DOWN to select the display, ENTER to start or exit a function.

If the backlight is OFF, any button press will turn the backlight ON.

POWER ON

As soon as power is applied to the VP-EC-RDU display, the screen will show:

**VP-EC-RDU
Press UP/DOWN/ENTER
Together
For Program Mode**

If valid data is written to the Holding Registers, then the display will show:

**LCD Line 1 Data
LCD Line 2 Data
LCD Line 3 Data
LCD Line 4 Data**

VP-EC-RDU Display Screens

To enter the display screen mode, Press the UP, DOWN and ENTER pushbutton simultaneously.

The display will show:

**VP-EC-RDU
Setup and
Programming
Select UP/DOWN**

Press the UP Button, the display will show:

**VP-EC-RDU
MODBUS ID**

xxx

where "xxx" is the current Modbus ID, range 1 thru 253



Press the UP Button, the display will show:

VP-EC-RDU
RS485
N,8,1
xxx

where "xxx" is the current Modbus Baud Rate
(9.6, 19.2, 57.4, 115.2 K)

Press the UP Button, the display will show:

VP-EC-RDU
Local Temperature

xx.x C

where "xx.x" is the current Temperature in Celcius

Press the UP Button, the display will show:

VP-EC-RDU
Software Version

x.x

where "x.x" is the current Software Version

Press the UP Button, the display will show:

VP-EC-RDU

Setup Program
Press ENTER

Enter the Program Menus, please see the next section

Press the UP Button, the display will show:

VP-EC-RDU
Exit
Return To Normal
Press ENTER

Exit the local display screens and return to normal operation.

NOTE: If the user does not press a pushbutton within the "Reset Menu Time", typically 60 seconds, the VP-EC-RDU will return to normal operation and wait for the next valid Modbus command.

If no valid commands are transmitted, the VP-EC-RDU will continue to show the last screen displayed. To re-enter the local and programming menus, the user must press UP, DOWN and ENTER simultaneously again.



4. PROGRAMMING OPERATION

PROGRAM MODE

To Enter the Program Mode, the user must press UP, DOWN and ENTER simultaneously to enter the local display mode. Press the UP button (Press and Release) until the local display shows:

VP-EC-RDU
Setup Program
Press Enter

Press ENTER:

VP-EC-RDU
Requires
Password
Press Enter

The VP-EC-RDU is Password protected, and ships from the factory with a default password value "0000"

The display will show the following:

0000
^
UP/DOWN for Value
ENTER for Next Digit

The Cursor ^ will start at the left most digit, and the UP / DOWN buttons are pressed until the desired value is reached.

To accept the value, the user presses ENTER and the Cursor will advance to the next digit where the selection process is repeated until a 4 digits are entered.

For a value of "0000" (the default password value), the ENTER button is pressed 4 times.

The Display will show:

VP-EC-RDU
Setup
Program
Press UP / DOWN

The user is now in the setup program. For each of the following menu items, press ENTER to select the item, adjust the value with the UP or DOWN buttons, and press ENTER to exit the program and return to the previous screen.

Press UP to continue:



Modbus ID:

VP-EC-RDU
Program
Modbus ID
Press ENTER



001
^
UP/DOWN for Value
ENTER for Next Digit

Modbus ID Range
1 thru 253
Default ID = 1

RS485 Baud Rate:

VP-EC-RDU
Program
RS485 Baud Rate
Press ENTER



VP-EC-RDU
UP/DOWN Adjust
19.2K Baud
Press ENTER Exit

Baud Rates Selection
9.6, 19.2, 57.4, 115.2 K
Default = 19.2K

LCD Contrast:

VP-EC-RDU
Program
Adjust LCD Contrast
Press ENTER



VP-EC-RDU
Adjust LCD Contrast
UP/DOWN
Press ENTER Exit

LCD Backlight Enable:

VP-EC-RDU
Program
LCD Backlight Enable
Press ENTER



VP-EC-RDU
Backlight = ON
UP = ON, DOWN = OFF
Press ENTER Exit

LCD Backlight
Default = ON

Normally the LCD Backlight is ON. If programmed OFF, then the backlight is on whenever a pushbutton is pressed and stays on during the Menu Reset Time. If no buttons are pressed during the Menu Reset Time, the backlight will turn OFF again.

Status LED Test:

VP-EC-RDU
Program
Status LED Test
Press ENTER



VP-EC-RDU
Status 1 Press UP
Status 2 Press DOWN
Press ENTER Exit

LED Test Function
Flash Green, Amber
Red, return to normal

Audible:

VP-EC-RDU
Program
Audible Enable
Press ENTER

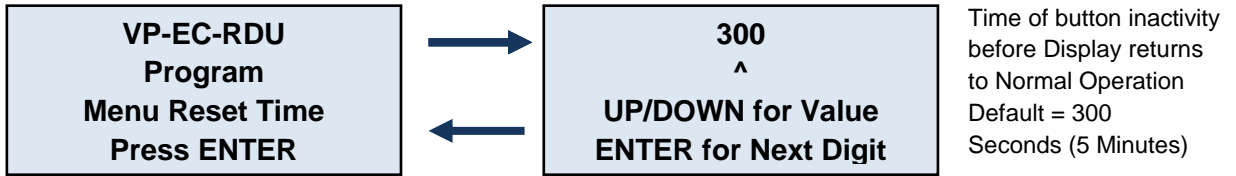


VP-EC-RDU
Audible = ON
UP = ON, DOWN = OFF
Press ENTER Exit

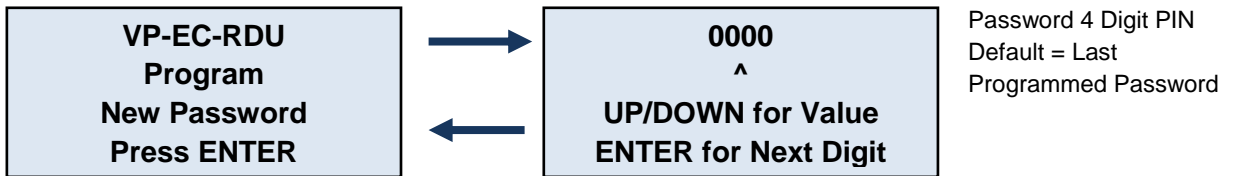
Audible Default = ON
Button Press "Click",
if Modbus = ON,
Audible "Beeps" once
per second



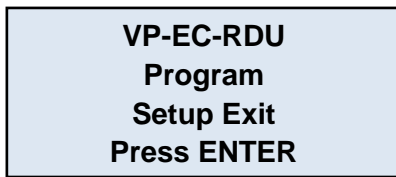
Menu Reset Time:



Password:



Exit Program Mode and return to Normal Display Operation



5. TEMPERATURE SENSOR

There is no calibration required for the Temperature Sensor. The VP-EC-RDU has been programmed with a Steinhart-Hart equation for calculating the temperature value based on the Thermistor reading and Thermistor Beta value ($B_{0/50} = 3380$). A 1% Thermistor is used and typically the accuracy is ± 1 °C over the operating range of -20 to +70 °C.

The temperature value can be read via Holding Register Address 50 (0x0032).
The reading has a x100 scaler, ie: 25.0 Deg C would have a value of 2500.



6. STATUS LEDES

The VP-EC-RDU has 2 Bi-Colour Status LEDs and 1 Blue Power ON LED.

The Status LEDs have 3 modes of operation and 3 colours:

CODE	LED Display
0x00	OFF
0x01	GREEN SOLID
0x11	GREEN SLOW FLASH
0x21	GREEN FAST FLASH
0x02	AMBER SOLID
0x12	AMBER SLOW FLASH
0x22	AMBER FAST FLASH
0x04	RED SOLID
0x14	RED SLOW FLASH
0x24	RED FAST FLASH

7. AUDIBLE

The VP-EC-RDU has an audible buzzer. The audible can be enabled or disabled from the main menu. When enabled, it provides a "Click" whenever a key is pressed. When turned on by writing a "1" to the Audible Holding Register, the audible will chirp once per second. When enabled and turned ON, it can be silenced by pressing the ENTER pushbutton.

8. PUSHBUTTONS

The VP-EC-RDU has 4 user pushbuttons that can be read via the pushbutton Holding Register.

HR VALUE	DESCRIPTION
0	No buttons pressed
8	MENU button pressed
4	UP button pressed
2	DOWN button pressed
1	ENTER button pressed

If more than one button is pressed, the button values are added together and display in the holding register.



9. RS485 AND MODBUS

MASTER – SLAVE:

Only a master can initiate a transaction. The display is a slave and will never initiate communication. The host system initiates transactions to write ASCII data to the corresponding registers. The host system shall also check status of the display pushbuttons periodically if required for the user's application.

PACKET IDENTIFICATION:

Any message (packet) starts with a silent interval of 3.5 characters. Another silent interval of 3.5 characters marks message end. Silence interval between characters in the message needs to be kept less than 1.5 characters. Both intervals are from the end of Stop-bit of previous byte to the beginning of the Start-bit of the next byte.

PACKET LENGTH:

According to the Modbus specification, the packet length shall be maximum 253 bytes including address and CRC. Maximum length of packet (serial line PDU including address byte and 2 bytes CRC) supported by the sensor is 28 bytes. Packets of larger size are rejected without any answer from sensor even if the packet was addressed to the sensor.

MODBUS DATA MODEL:

- Read Holding register (read 16 bit word).
- Write Multiple Holding Registers

SUPPORTED FUNCTION

FUNCTION	03
FUNCTION	16

EXCEPTION RESPONSES:

Slave will send answer to the master only in the case of valid message structure. Nevertheless, it can send exception response because of detection of:

- Invalid function code.
- Invalid data address (requested register doesn't exist in given device).
- Invalid data.
- Error in execution of requested function.

RTU transmission mode is the only mode supported by the VP-EC-RDU Display

DEFAULT CONFIGURATION:

- 8 - bit binary
- 1 start bit
- 8 data bits, least significant bit first
- NO Parity
- 1 Stop bit

BAUD RATE: Programmable 9.6K, 19.2K, 57.4K or 115.2K Baud



10. HOLDING REGISTERS

HOLDING REGISTERS

FUNCTION "03" and Function "16"

Read / Write Registers

Dec	Hex		
00	0x0000	LCD Line 1	ASCII Character 1 High Byte, Character 2 Low Byte
01	0x0001	LCD Line 1	ASCII Character 3 High Byte, Character 4 Low Byte
02	0x0002	LCD Line 1	ASCII Character 5 High Byte, Character 6 Low Byte
03	0x0003	LCD Line 1	ASCII Character 7 High Byte, Character 8 Low Byte
04	0x0004	LCD Line 1	ASCII Character 9 High Byte, Character 10 Low Byte
05	0x0005	LCD Line 1	ASCII Character 11 High Byte, Character 12 Low Byte
06	0x0006	LCD Line 1	ASCII Character 13 High Byte, Character 14 Low Byte
07	0x0007	LCD Line 1	ASCII Character 15 High Byte, Character 16 Low Byte
08	0x0008	LCD Line 1	ASCII Character 17 High Byte, Character 18 Low Byte
09	0x0009	LCD Line 1	ASCII Character 19 High Byte, Character 20 Low Byte
10	0x000A	LCD Line 2	ASCII Character 1 High Byte, Character 2 Low Byte
11	0x000B	LCD Line 2	ASCII Character 3 High Byte, Character 4 Low Byte
12	0x000C	LCD Line 2	ASCII Character 5 High Byte, Character 6 Low Byte
13	0x000D	LCD Line 2	ASCII Character 7 High Byte, Character 8 Low Byte
14	0x000E	LCD Line 2	ASCII Character 9 High Byte, Character 10 Low Byte
15	0x000F	LCD Line 2	ASCII Character 11 High Byte, Character 12 Low Byte
16	0x0010	LCD Line 2	ASCII Character 13 High Byte, Character 14 Low Byte
17	0x0011	LCD Line 2	ASCII Character 15 High Byte, Character 16 Low Byte
18	0x0012	LCD Line 2	ASCII Character 17 High Byte, Character 18 Low Byte
19	0x0013	LCD Line 2	ASCII Character 19 High Byte, Character 20 Low Byte
20	0x0014	LCD Line 3	ASCII Character 1 High Byte, Character 2 Low Byte
21	0x0015	LCD Line 3	ASCII Character 3 High Byte, Character 4 Low Byte
22	0x0016	LCD Line 3	ASCII Character 5 High Byte, Character 6 Low Byte
23	0x0017	LCD Line 3	ASCII Character 7 High Byte, Character 8 Low Byte
24	0x0018	LCD Line 3	ASCII Character 9 High Byte, Character 10 Low Byte
25	0x0019	LCD Line 3	ASCII Character 11 High Byte, Character 12 Low Byte
26	0x001A	LCD Line 3	ASCII Character 13 High Byte, Character 14 Low Byte
27	0x001B	LCD Line 3	ASCII Character 15 High Byte, Character 16 Low Byte
28	0x001C	LCD Line 3	ASCII Character 17 High Byte, Character 18 Low Byte
29	0x001D	LCD Line 3	ASCII Character 19 High Byte, Character 20 Low Byte
30	0x001E	LCD Line 4	ASCII Character 1 High Byte, Character 2 Low Byte
31	0x001F	LCD Line 4	ASCII Character 3 High Byte, Character 4 Low Byte
32	0x0020	LCD Line 4	ASCII Character 5 High Byte, Character 6 Low Byte
33	0x0021	LCD Line 4	ASCII Character 7 High Byte, Character 8 Low Byte
34	0x0022	LCD Line 4	ASCII Character 9 High Byte, Character 10 Low Byte
35	0x0023	LCD Line 4	ASCII Character 11 High Byte, Character 12 Low Byte
36	0x0024	LCD Line 4	ASCII Character 13 High Byte, Character 14 Low Byte
37	0x0025	LCD Line 4	ASCII Character 15 High Byte, Character 16 Low Byte
38	0x0026	LCD Line 4	ASCII Character 17 High Byte, Character 18 Low Byte
39	0x0027	LCD Line 4	ASCII Character 19 High Byte, Character 20 Low Byte

**HOLDING REGISTERS****FUNCTION "03" and Function "16"****Read / Write Registers**

Dec	Hex	
40	0x0028	STATUS LED 1
41	0x0029	STATUS LED 2
42	0x002A	Audible
43	0x002B	Not Used
44	0x002C	Not Used
45	0x002D	Not Used
46	0x002E	Not Used
47	0x002F	Not Used
48	0x0030	Not Used
49	0x0031	Not Used

HOLDING REGISTERS**FUNCTION "03"****Read Only Registers**

Dec	Hex	
50	0x0032	Temperature Deg.C x 100 Scale ie: 25 Deg C reads 2500
51	0x0033	Modbus ID
52	0x0034	Baud Rate
53	0x0035	LCD Contrast Value
54	0x0036	LCD Backlight Enable
55	0x0037	Audible Enable
56	0x0038	Menu Reset Time
57	0x0039	Password
58	0x003A	Pushbutton Values
59	0x003B	Not Used



11. PROPRIETARY STATEMENT

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13. REVISIONS TO MANUAL

All information contained in this manual is believed to be true and correct at the time of printing. However, as part of its continuing efforts to improve its products and their documentation, VP Process Inc. reserves the right to make changes at any time without notice. Any revised copies of this manual can be obtained by writing VP Process Inc.

14. SERVICE POLICY

VP Process Inc. maintains an instrument service facility at the factory. VP Process Inc. assumes no liability for service performed by other than VP Process Inc. personnel. Repairs are warranted for 90 days from date of shipment. Should your instrument require non-warranty repair, you may contact the distributor from whom it was purchased., or you may contact VP Process Inc. directly.

If VP Process Inc. is to do the repair work for you, you may send the instrument, prepaid, to VP Process Inc. ATTN: Service Department. Always include your address, purchase order number, shipping and billing information, and a description of the defect, as you perceive it. If you wish to set a limit to the authorized repair cost, please state a "not to exceed" figure. If you must have a price quotation before you can authorize the repair cost, so state, but understand that this involves extra cost and extra handling delay. The Company's policy is to perform all needed repairs to restore the instrument to full operating condition.

To expedite the repair operation, it is required to call in advance to VP Process Inc 250.769.8220, obtain a Return Materials Authorization number (RMA#), describe the nature of the problem and provide a purchase order number. If this is the first time you are dealing directly with the factory, you will be asked to provide credit references, prepay, or authorize COD shipment. Pack the instrument and all its accessories (preferably in its original packing). Enclose your Purchase Order, shipping and billing information, RMA#, and any special instructions.



15. CONTACT INFORMATION

VP Process Inc.

TEL: 1-250-769-8220

WEB: www.vpprocess.com

Email: info@vpprocess.com

16. STANDARD WARRANTY

VP Process Inc. warrants equipment manufactured and sold by us to be free from defects in materials and workmanship for a period of one year from date of shipment from VP Process Inc. Any parts found defective within that period will be repaired or replaced, at our option, free of charge, f.o.b. factory. This warranty does not apply to those items which by their nature are subject to deterioration or consumption in normal service, and which must be cleaned, repaired or replaced on a routine basis.

Warranty is voided by abuse including rough handling, mechanical damage, and operation, alteration, or repair procedures not in accordance with instruction manual. This warranty indicates the full extent of our liability, and we are not responsible for removal or replacement costs, local repair costs, transportation costs, or contingent expenses incurred without our prior approval.

VP Process Inc.'s obligation under this warranty shall be limited to repairing or replacing, and returning any product which VP Process Inc. material review board examination shall disclose to its satisfaction to have been defective. To receive warranty consideration, all products must be returned to VP Process Inc. its manufacturing facilities with transportation charges prepaid.

This warranty is expressly in lieu of any and all other warranties and representations, expressed or implied, and all other obligations or liabilities on the part of VP Process Inc. including but not limited to, the warranty of merchantability or fitness for a particular purpose. In no event shall not be limited to, the warranty of merchantability or fitness for a particular purpose. In no event shall VP Process Inc. be liable for indirect, incidental or consequential loss or damage of any kind connected with the use or its products or failure of its products to function or operate properly.

This warranty covers instruments and parts sold (to users) only by authorized distributors, dealers and representatives as appointed by VP Process Inc.