

VitalSensors PROFIBUS PA Instruments with Rockwell PLC and SST card

Connecting a VitalSensors PROFIBUS PA Instrument to Rockwell PLC with SST card

Objective:

- Become familiar with the instrument wiring requirements and PROFIBUS PA
- Become familiar Rockwell PLC and SST card

Equipment:

- Rockwell PLC5 xxE
- SST Profibus Card
- VS-1000 Sensor System with Profibus PA support
- PC
- RSLogix Software
- DP/PA segment coupler

While every effort was made to verify the following information, no warranty of accuracy or usability is expressed or implied.

17.5 Profibus PA Communications with a Rockwell PLC5 80E

See Figure 17-22 for a sample of the physical setup of PROFIBUS PA:

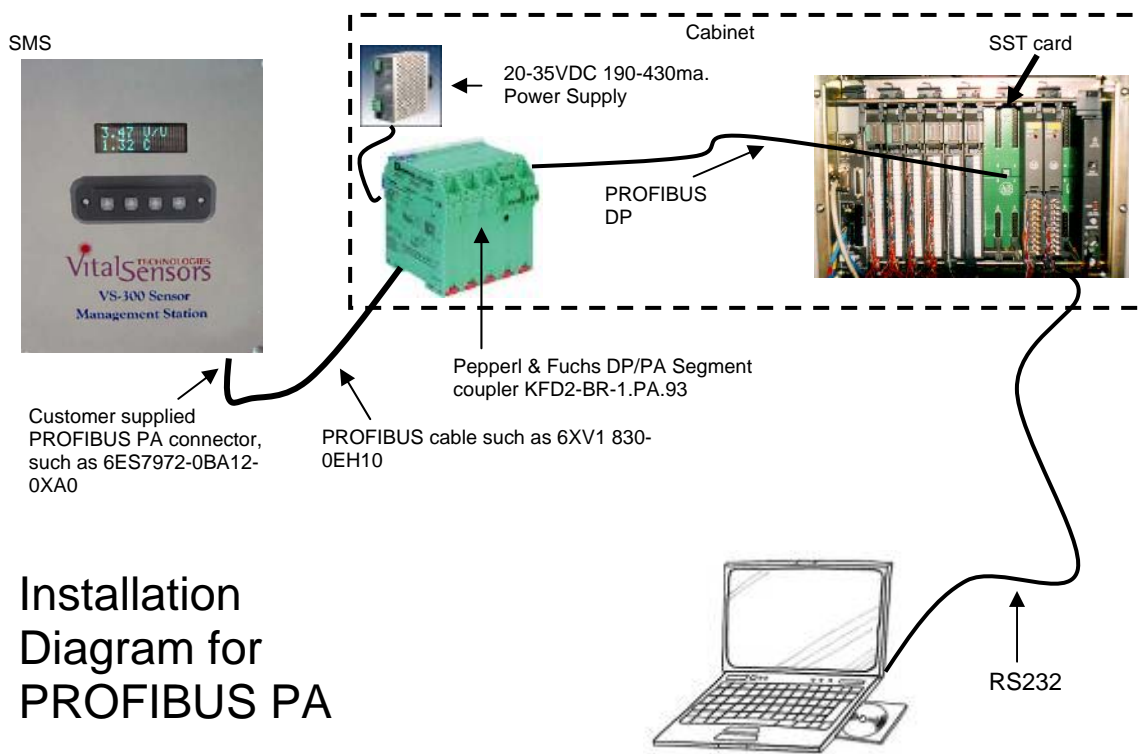


Fig. 17-22

The configuration shown in Figure 17-22 represents VitalSensors Technologies' laboratory setup and does not represent the only possible hardware configuration. It is intended to be a sample configuration.

Profibus Network Setup:

1. Connect VS-300 Sensor Management Station to a Pepperl and Fuchs (or equivalent) DP to PA coupler. The Profibus connector on the Sensor Management Station is the one marked Fieldbus
2. Connect DP side of coupler to SST card in PLC5/80E.
3. Connect 24VDC to coupler.
4. Connect PC client running Allen Bradley RSlogix PRO 5™ software and Woodhead SST setup software. One RS232 port on client is connected to PLC5/80E com port (special Allen Bradley cable) and one RS232 on client to SST serial port (null modem cable). The PLC's own Ethernet port, if available, may be used instead of a serial line and is certainly faster than the serial port.
5. Setup Woodhead SST card according to instruction provided by manufacturer and Allen-Bradley PLC 5 Programming Standards for using SST-PFB-PLC5 hardware.

The GSD files – VS300A28.gsd and pa_139700.gsd -- are on the enclosed CD.

Use the VitalSensors Technologies GSD file VS300A28.GSD.

The VS-1000C sensor uses PROFIBUS PA Station Address 126 as a factory default, but another Station Address can be set as needed using Simatic PDM or the procedure using the Great Communicator outlined below.

Connect Sensor to Sensor Management Station with cable provided and follow installation checklist provided by VitalSensors Technologies to ensure that the sensor has proper preparation before normal operation.

The Sensor Management Station has been preset at the factory to any Station Address specified by the customer and to output data via its Profibus PA communications port.

Once the Sensor Management Station is running and displaying normal values, the PLC will automatically scan – via the SST card – the PROFIBUS DP bus. Except for the station address, there is normally no need to change any settings in the Sensor Management Console and the PROFIBUS PA communications software automatically starts upon power on of Sensor Management Station.

The PLC – via the RSLogix 5™ Pro software – will display the metadata in the SST selected integer addresses. (See page 15 in Allen-Bradley PLC 5 Programming Standards for using SST-PFB-PLC5 hardware).

The PROFIBUS PA hardware and Great Communicator software have been designed to display VS1000C Carbonation and Temperature values in PROFIBUS PA floating point format. The Status Bytes appear correctly in the integer register, but the Concentration and Temperature must be moved via ladder diagram to a floating point register. A sample ladder diagram is provided on the CD as an illustration.

Before continuing the PROFIBUS PA setup, it is necessary to describe the Great Communicator software.

17.6 VS-300 SMC Great Communicator Network Interface Application

Terminal.exe is the name of the Great Communicator executable file in the Sensor Management Console directory.

Sensor Management Station Communications Software Setup:

The Great Communicator can be started independently if the Sensor Management Console program has stopped. The Great Communicator program starts automatically as a result of the SMC program starting, but it also may be started on its own for setup purposes. All VitalSensors Technologies software is located in the following system directory

C:\Program Files\Sensor Management Console. There is a desktop icon for this purpose.

Do not delete or alter files in this directory or else improper functioning of the sensor will result. The settings for the Great Communicator and SMC are stored in this directory and if any changes are made to the Great Communicator, the defaults are stored in a text file in this directory.

The VitalSensors communications software – Great Communicator – is automatically invoked when the Sensor Management Console runs upon power up of the Sensor Management Station. There are several components to the Great Communicator Software that are accessed during initial installation of the Sensor Management Station. The three major components of the Great Communicator software are:

1. PROFIBUS PA Modbus
2. Current Loop Modbus TCP/IP (4-20mA)
3. EtherNet/IP Modbus RTA

The Sensor Management Console is shipped from the factory with the communications default setting selected according to the purchase order. For Current Loop (4-20mA) and EtherNet/IP there are user selectable limits for certain parameters to work at particular installations. The IP address is also settable. PROFIBUS PA has a setting for the PROFIBUS PA station address.

The main window for the Great Communicator appears as below and is viewable using the Remote Desktop Connection Software.

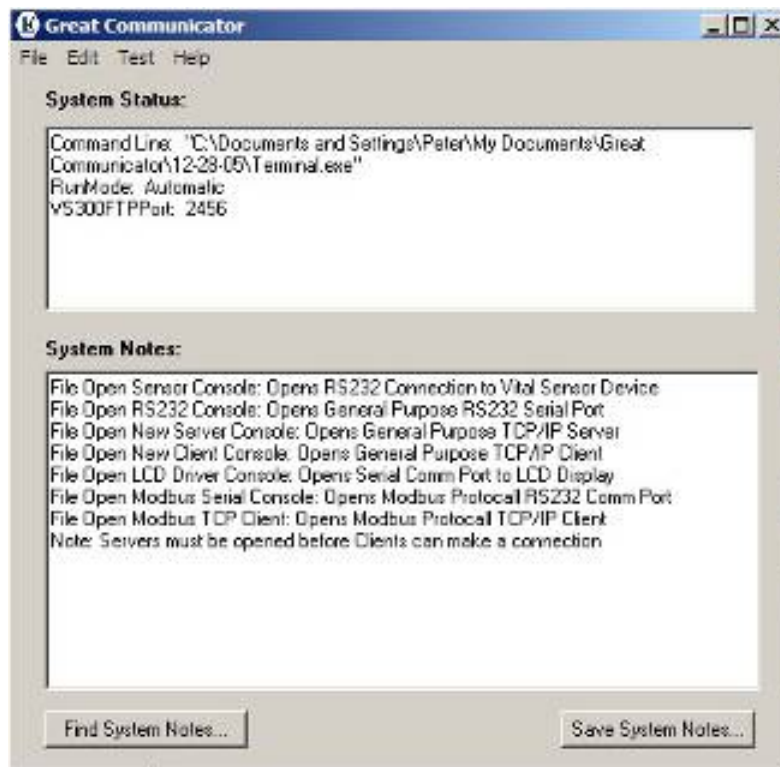
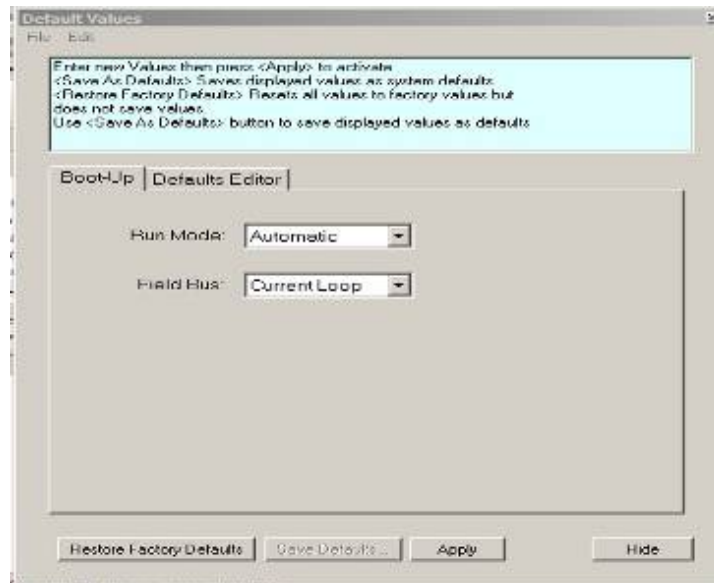


Fig. 17-23

From this window all the other communication modes can be invoked (as well as test modes which will not be covered here). In order to change from one mode to another the previous mode must be stopped or else communications device contention might occur. The File menu item is used to access other modes.

In order to save a particular startup mode, the default values must be set and saved. Use the Edit menu item to invoke the Default Values dialog box as shown below:



As shown in this example, the program is set to start in Current Loop mode. Use the Apply button and then Save Defaults button to save to the same directory where the Sensor Management Console and Great Communicator are found. You will be asked to overwrite the existing file which you must do if you wish to save the settings.

The Save Default button will activate after the Apply Button is pressed. The Save Default Button must be activated if the setting changes are to be made permanent. If the file GreatCommunicatorDefaults.txt is not in the same directory as the Sensor Management Console, the program will not start with the saved parameters.

PROFIBUS PA Station Address

Make sure that the Great Communicator default settings window has been set to PROFIBUS PA and automatic. Save the settings in the same directory as the program Terminal.exe (Great Communicator) is stored. Ordinarily the setting should not have to be changed because the unit is shipped according to the purchase order for PROFIBUS PA.

In PROFIBUS PA mode the only user setting is the PROFIBUS PA station address. There are no other settings that the user can make, but the window can serve as a comparison to the data input to the PLC. Do not press any other buttons in the window as they are for troubleshooting purposes only. Once any button is pressed, the Sensor Management Console program should be stopped, along with Terminal.exe, and then the SMC should be restarted.

Also, if the data flickers slightly on the bottommost window, it indicates if cyclic data exchange is occurring over PROFIBUS. The topmost left window indicates that data is flowing into the Great Communicator and the topmost right window indicates that data is flowing to the PROFIBUS PA interface.

To change the PROFIBUS PA station address (power must be applied to PROFIBUS PA):

1. Access the Sensor Management Station Administrator account using Remote Desktop Connection from any Windows XP PC on the same subnet as the Sensor Management Station.
2. On figure 17-25 below you will see a row labeled “Profibus Station Address”. Under the column Byte0 enter the desired station address number into that cell.
3. Press “Set New PA Address” button and the address will change.
4. Stop the Sensor Management Console and Terminal.exe manually and then restart the Sensor Management Console. Terminal.exe will automatically restart and cyclic data exchange will occur over the new station address.
5. The number in the cell will not reflect the changed station address, but the address has in fact changed.
6. The station address can be verified at the PLC PROFIBUS PA interface. The SST card program can be used to determine the station address setting by using the “Scan” option. If the address is different than the setting, the address will be indicated in the SST card program’s lowermost window.

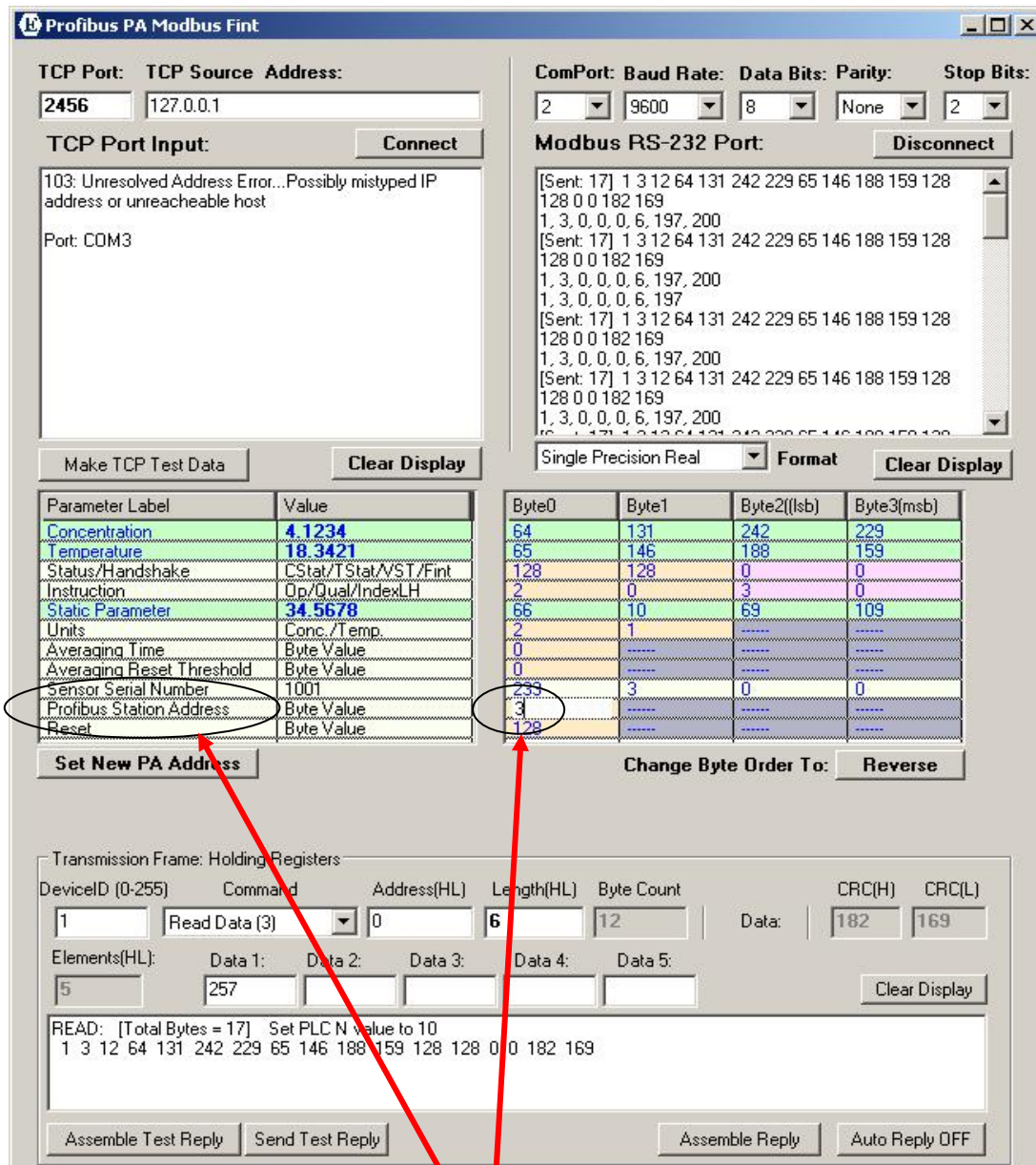


Fig. 17-25

Station Address

The VS-300 Sensor Management Station Profibus PA implementation also supports the changing of the station address via a software application like Simatic PDM via the Profibus Set_Slave_Add_supp

As shown in Fig. 17-25, there are two values, Concentration and Temperature plus status bytes for each sent to the PLC via PROFBUS PA. The values for each Parameter are shown in the Value column. The actual binary data are shown in the columns Byte0 to Byte3 and the format is an integer format that is converted to Floating Point in the PLC.

The VS-300 Sensor Management Station has the ability to output data in integer or floating point formats. The floating point format meets the requirements of IEEE 734

The other values in the table – Instruction, Static Parameter, Units, etc. -- are used for two-way communications with the instrument via Siemens PDM software (purchased separately from Siemens).

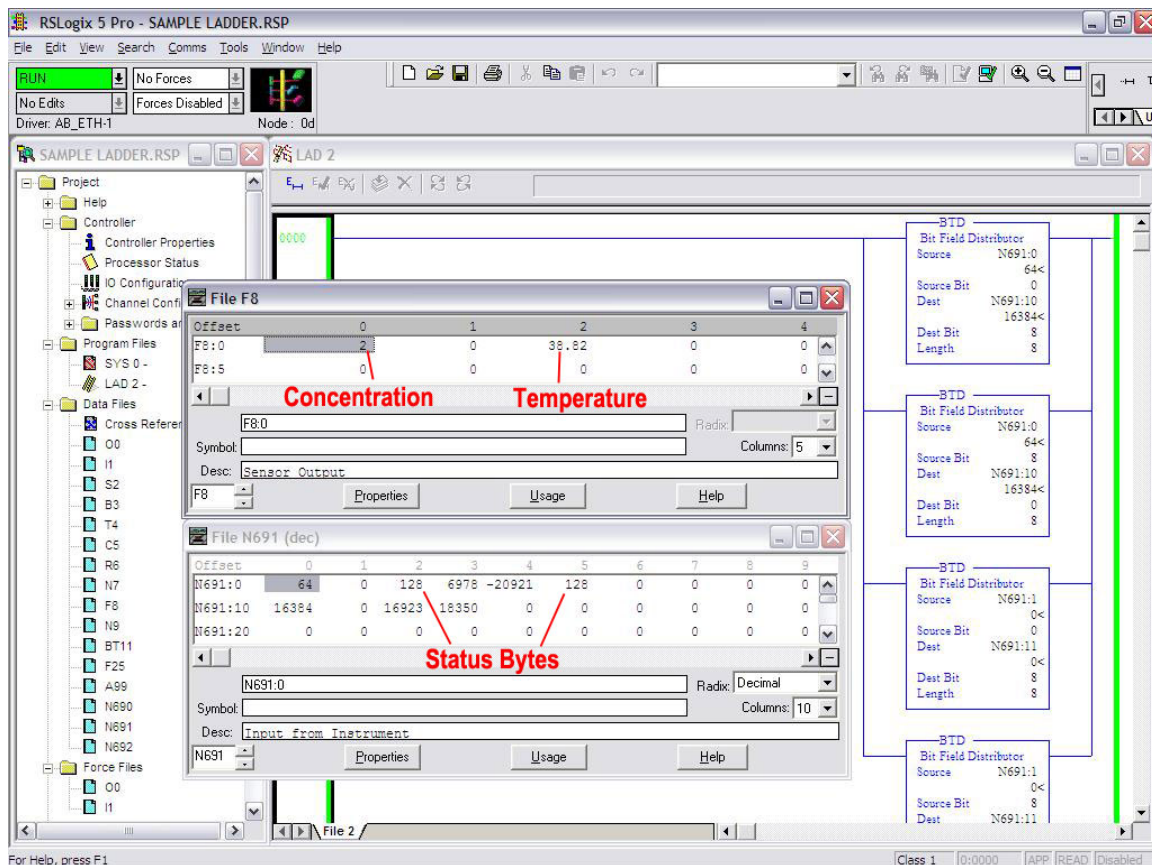


Fig. 17-26

The above screen shot from the Allen-Bradley RSlogix PRO 5™ software, Figure 17-26, illustrates the Concentration and Temperature values as they arrive in the PLC in the floating point register F8. The Status Bytes are shown in the integer register in N691:2 and N691:5 and both are indicating “good data” with the code 128. The rest of the values in the integer register are raw data before it is converted and moved to the floating point register.

The Status Bytes shown in the integer register are encoded as follows:

Status	Status Byte
Good data	128
Data:	
Non specific error	0
Configuration error	4
Not connected	8
Device failure	12
Sensor failure	16
Bad – no connection. Last usable value	20

There are many other possible codes for the Status Bytes which are available in PROFIBUS PA that are not implemented here. For a complete description of Status Bytes please refer to the PROFIBUS trade organization’s Specification Profile for Process Control Devices order number 3.042.

VitalSensors Technologies PROFIBUS PA implementation is compliant with the PROFIBUS trade organization’s profile for a PROFIBUS PA Transmitter and is registered with the Organization.

Current Loop mode

In Current Loop mode, the following window will appear. The settings that can be changed are:

Modbus Server Address. This is set according to the customer’s internal network requirements. VitalSensors sets this to 192.168.1.78. The other settings that are important are Min Concentration, Max Concentration, Min Temperature, Max Temperature, Min Count, and Max Count. These settings set the limits for concentration, temperature, and the A/D counts output to the AcroMag converter module. The resolution of each measurement is equal the maximum minus the minimum parameter divided by the maximum minus the minimum A/D counts. The AcroMag has a range of 20,000 A/D counts and this is put in to the Great

Communicator as the default. Once these settings are made they must be saved in the Default Values menu dialog box. If this is not done, the settings will not be remembered by the program. Do not change VS-300 TCP/IP address, VS-300 Port, or the Modbus Port. Only Modbus Server Address can be changed.

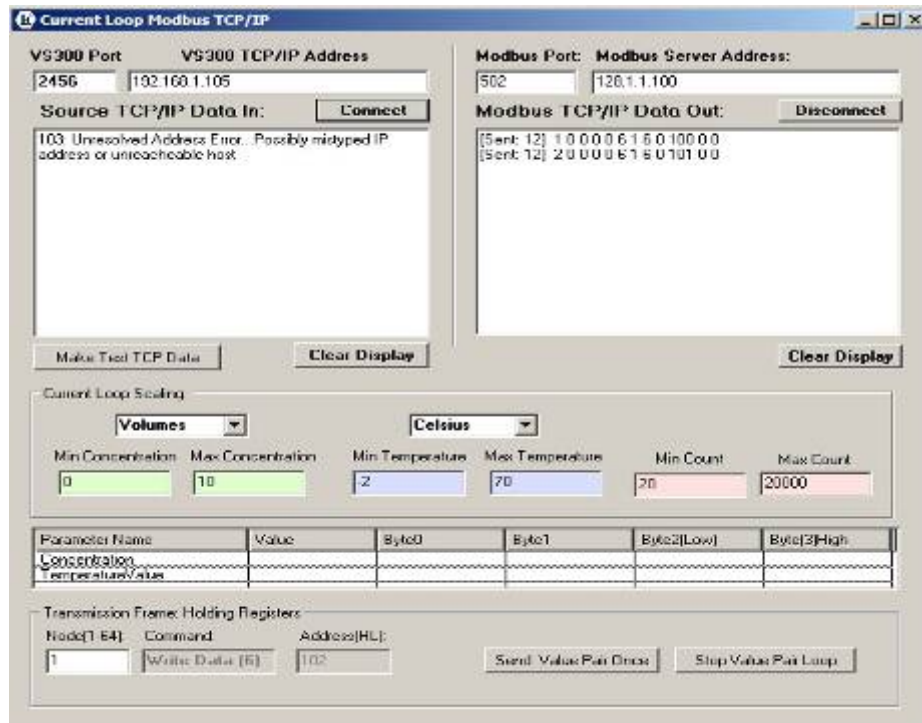


Fig. 17-27

18. Error Messages for Fieldbus Installations (Error Codes)

Error Codes	Problems Possible Causes
0	No error
1	No communication, check cable if duration is more than one minute
2	Power out of range, check power and voltage to the Sensor Management Station
4	Concentration out of range, default settings are 0 to 10 Volumes of CO2, check process and CO2 references
8	Temperature greater than maximum, CIP temperature too high, shut off sensor or bring down CIP temperature
16	Sensor occluded, CIP required or check condition of sensor crystal if CIP is not effective



Please note that combinations of the above error codes are also possible. For example: **an error code of 20** would mean that the concentration is out of range and the sensor is occluded. An **error code of 3** would mean that there is no communication from the sensor and power is out of range. The above error codes will also be implemented on PROFIBUS in the future.

19. Troubleshooting

19.1 No Measurement or Invalid Reading

Reason	Comment
The sensor is not connected to the Sensor Management Station	Connect or check the sensor cable that should be connected to the Sensor Management Station
The sensor has not been installed in pipe	Check sensor installation
Power to the Sensor Management Station is not on	Check power connections at the Sensor Management Station and insure that the system is turned on at switch inside enclosure
The pipe or tank has no product or fluid	The pipe or tank where the sensor is attached must have fluid or product for the sensor to read correctly
Sensor Management Station display cable could be damaged or loose	Check display cable in Sensor Management Station for damage or loose cable

19.2 Measuring Value is Unstable

Reason	Comment
The power to the Sensor Management System is not correct	Check power supply to the unit to insure stable clean power. Check connections and source of AC power
Sensor crystal in pipe is occluded	Perform clean in place and check location of fitting to insure it discourages build up of residue on sensor crystal
Power to the Sensor Management Station is not on	Check power connections at the Sensor Management Station and insure that the system is turned on at switch inside enclosure
Weekly reference checks have not been performed	Perform reference checks and set offsets if required
Gas bubbles in the line or tank	Gas bubbles can affect measurement. Check that the line pressure is sufficiently high to keep the CO ₂ dissolved.

19.3 Measurement Value Does Not Match My Traditional Method

Reason	Comment
VS-1000C measures true CO2	Adjust CO2 measurement to meet traditional method through product brand offsets
Wrong brand selected	Select brand and proper offset for comparison
Pressure changes in lines	Traditional instrument reading are affected by changes in line pressure – VS-1000C reading are not affected and will be more consistent
Presence of other gases in measured product	Traditional instruments are affected by the pressure caused by other gases such as oxygen