INSTRUCTION MANUAL

for the

Varec 6820 Series

Tank Scanning Unit (TSU)

Document Number 33-09247

Installation, Operation, Maintenance and Troubleshooting

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Issued: July 1989 - Revision A
November 1990 - Revised
February 1991 - Revision B
November 1992 - Revision C

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Safety Precaution Definitions

CAUTION
Damage to equipment may result if this precaution is disregarded.

WARNING
Direct injury to personnel or damage to equipment or data may result if this precaution is not followed.

Safety Precautions

CAUTION
READ AND UNDERSTAND THIS INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON THE VAREC 6820 SERIES TANK SCANNING UNIT. FOLLOW ALL PRECAUTIONS AND WARNINGS NOTED HEREIN WHEN INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON THIS EQUIPMENT.

WARNING
Do not apply power to the Varec 6820 Series Tank Scanning Unit until all wiring connections have been made. Power to the TSU must be OFF before performing service.

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Table of Contents

Section 1 - Introduction

Using This Manual 1
Getting Acquainted With The Tank Scanning Unit 1

Section 2 - Installation

Overview 5
Commissioning 5
Equipment Checklist 5
Standard Equipment 6
Optional Equipment 6
Jumper Block Settings 6
4-Wire Transmitter Wiring 7
Matrix Transmitter Wiring 12
TSU to Computer Communications 13
TSU to Modem Communications 14
Starting the System on the Test Bench 15
Loading the Varec Diagnostic Software 15
Entering the TSU Configure Mode 15
Configuring a Tank 17
Gauging a Tank 17
Terminating the Test 17
Mechanical Installation 17
Environmental 18
Accessibility 18
Mounting 18
Electrical Installation 18
Uninterruptable Power Supply (UPS) Considerations 18
Wire and Cable Installation 18
System Grounding Considerations 19
4-Wire Transmitter Wiring Considerations 23
Matrix Transmitter Wiring Considerations 24
IFU Wiring Considerations 25
Termination Board Wiring 25
Termination Board Pin Assignments 26
System Installations 26

Section 3 - Operation

Overview 29
Host and TSU Communication 29
TSU Error Responses to Host Commands 30
TSU Data Responses to Host Commands 31
Raw or Normal Data Format (No Flags Set) 31
Diagnostic Data Format (Flag D Set) 31
Converted Data Format (Flag C Set) 32
Formatted Data Format (Flags CF Set) 32
Raw and Converted Data Formats (Flags BC Set) 33
Raw and Formatted Data Formats (Flags BCF Set) 33

Section 4 - Maintenance and Troubleshooting

Maintaining the Tank Scanning Unit 35
Troubleshooting the Tank Scanning Unit 35
Startup Guide 36
Gateway Communications 37

Section 5 - Specifications and References

Recommended Spare Parts 41
Specifications and Physical Characteristics 42
Service Conditions 42
Dimensions and Weights 43

Appendix A - Software Configuration

Configuring the System 45
Loading the Computer Diagnostic Software 45
Entering the TSU Configure Mode 45
Programming the 4-Wire Module 46
Programming the IFU Module 48
Programming the Matrix Module 52

Appendix B - Gateway Utilities Software

Introduction 55
System Configuration 55
Installation 55
Hard Disk Drive Installation 56
Floppy Disk Drive Installation 56
Setup 56
4-Wire Transmitters 57
Matrix Transmitters 59
GWUTIL.EXE Program 61
Installation and Operation 61
Main Menu Options 61
1. Change Port Configuration 61
2. Save Port Configuration 62
3. Enter Tank Data to Disk 62
4. Print Tank Data Base Report 67
5. Download All Tanks to Gateway 67
6. Upload Tanks to Disk 67
7. Add Tanks to Gateway Data Base 67
8. Exit Utilities to DOS 68
File Organization 68
GWCON.01 68
TANKNUM 68
XMTRNAM 68
XMTRTYPE 69
Tank Data File Formats 69
4-Wire Tanks 69
Matrix Tanks 70

Technical Notes 70
Program Operation Notes 70

Index 71

List of Illustrations

Figure 1-1 Varec 6820 Series Tank Scanning Unit (4-Wire & Matrix) 2
Figure 1-2 Varec 6820 Series Tank Scanning Unit (IFU) 3
Figure 2-1 Jumper Block Locations) 6
Figure 2-2 Wiring with 4-Wire Transmitters 8
Figure 2-3 Wiring with Multifunction Transmitters 9
Figure 2-4 Wiring with Servo Gauges 10
Figure 2-5 Wiring with Model 6603 11
Figure 2-6 Wiring with Matrix Transmitters 12
Figure 2-7 RS-232 Cable 13
Figure 2-8 RS-232 Modem Cable 14
Figure 2-9 Power Panel Assembly 16
Figure 2-10 Basic Installation Dimensions 19
Figure 2-11 Proper System Grounding With UPS 22
Figure 2-12 Proper System Grounding With Host Computer 23
Figure 2-13 4-Wire Termination Board Assembly 26
Figure 2-14 Matrix Termination Board Assembly 28
Figure 2-15 Termination Board Schematic 29
Figure 2-16 TSU Applications 32
Figure 4-1 4-Wire Module Area Fuses 40
Figure 4-2 Gateway Board LED Indicators 42
Figure 4-3 TSU Electrical Wiring Diagram 43

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Addendum #1 to the Varec Tank Scanning Unit Manual

September 27, 1993

Software Release V2.28

a. Switch 15 (JP22) will cause a delay of 1.5 seconds on a bad or no transmitter error. This feature was added to compensate for time delays in the Model 6603 Tankside Receiver.

b. The timeout delay for 4-wire and IFU 4-wire communications delay was increased from 50 ms to 300 ms. The increased delay compensates for potential longer response times from the Model 4100 MFT under certain conditions.

SECTION 1 - INTRODUCTION

Using This Manual

This manual is designed to assist the user with the installation, operation, maintenance and troubleshooting of the Varec 6820 Series Tank Scanning Unit (TSU), and is organized accordingly.

- Section 1 - Introduction
- Section 2 - Installation
- Section 3 - Operation
- Section 4 - Maintenance and Troubleshooting
- Section 5 - Specifications and References

- Appendix A - Software Configuration
- Appendix B - Gateway Utilities Software

Getting Acquainted With The Tank Scanning Unit

The Varec 6820 Series Tank Scanning Unit (TSU) is designed to provide a rugged, reliable interface between Varec field transmitters and a host computer. The TSU operates as a slave to the host computer, which is typically an IBM PC compatible, executing the Varec TankView or Varec System IV Tank Gauging Software program. The TSU polls a specific transmitter upon request from the host and responds with the requested data. Any computer supporting asynchronous serial communication on a RS-232 electrical interface can be a host.

Tank configuration parameters are loaded into NVRAM (Non-Volatile Random Access Memory) when programming the Varec Gateway board in the software configuration mode.

A cable connects the TSU and the serial communication port of the host computer. Maximum length of the cable is 50 feet. Line drivers or modems can be installed for longer distances. Low capacitance cable may be used for greater distances in certain installations.

The TSU provides 48 VDC to the field transmitters, eliminating the need to run AC or DC power to the field instruments. The 3 Amp power supply is sufficient for 150 4-Wire Transmitters, 100 Matrix Transmitters or 100 Multifunction Transmitters.

Use of transmitter boards other than those manufactured by Whessoe Varec, Inc. can cause power problems. Imitations of Varec transmitters usually draw considerable power and can seriously downgrade system performance. Whessoe Varec, Inc. does not warranty operation of the Tank Scanning Unit when used with equipment not manufactured by Whessoe Varec, Inc.

The TSU is available in three different model options.

- Varec 4-Wire Transmitters
- Varec Matrix Transmitters
- Directly to a Varec Interface Field Unit (IFU)

Transient and surge protection via gas caps are standard on 4-wire and matrix models. Limiting resistors are found on the 4-wire daughter board module. The IFU provides such protection and is not required in the TSU when the IFU model is used. Matrix versions feature gas caps and current limiting resistors.

Refer to Appendix A, *Software Configuration*, for information on programming the TSU with different transmitters.

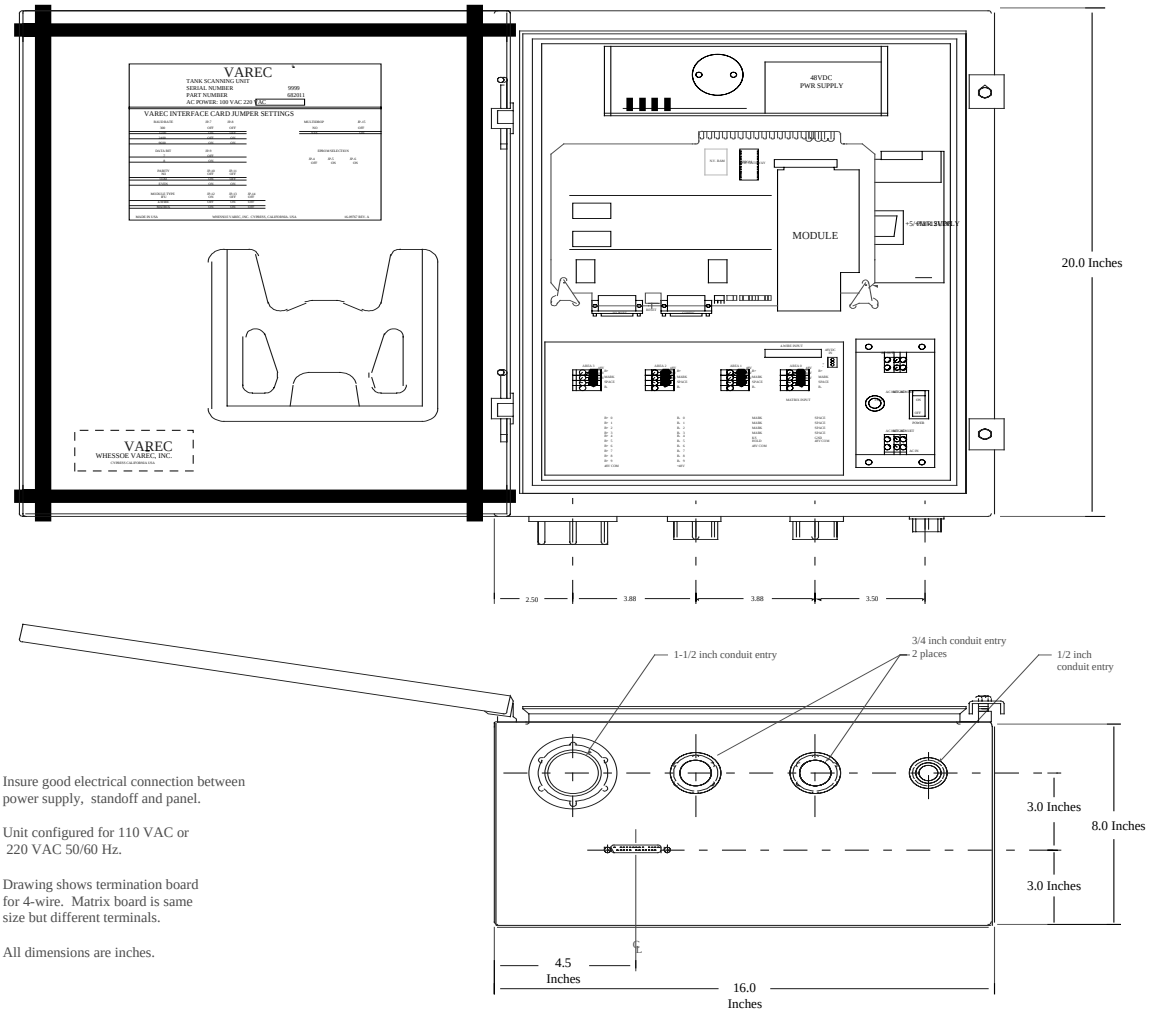
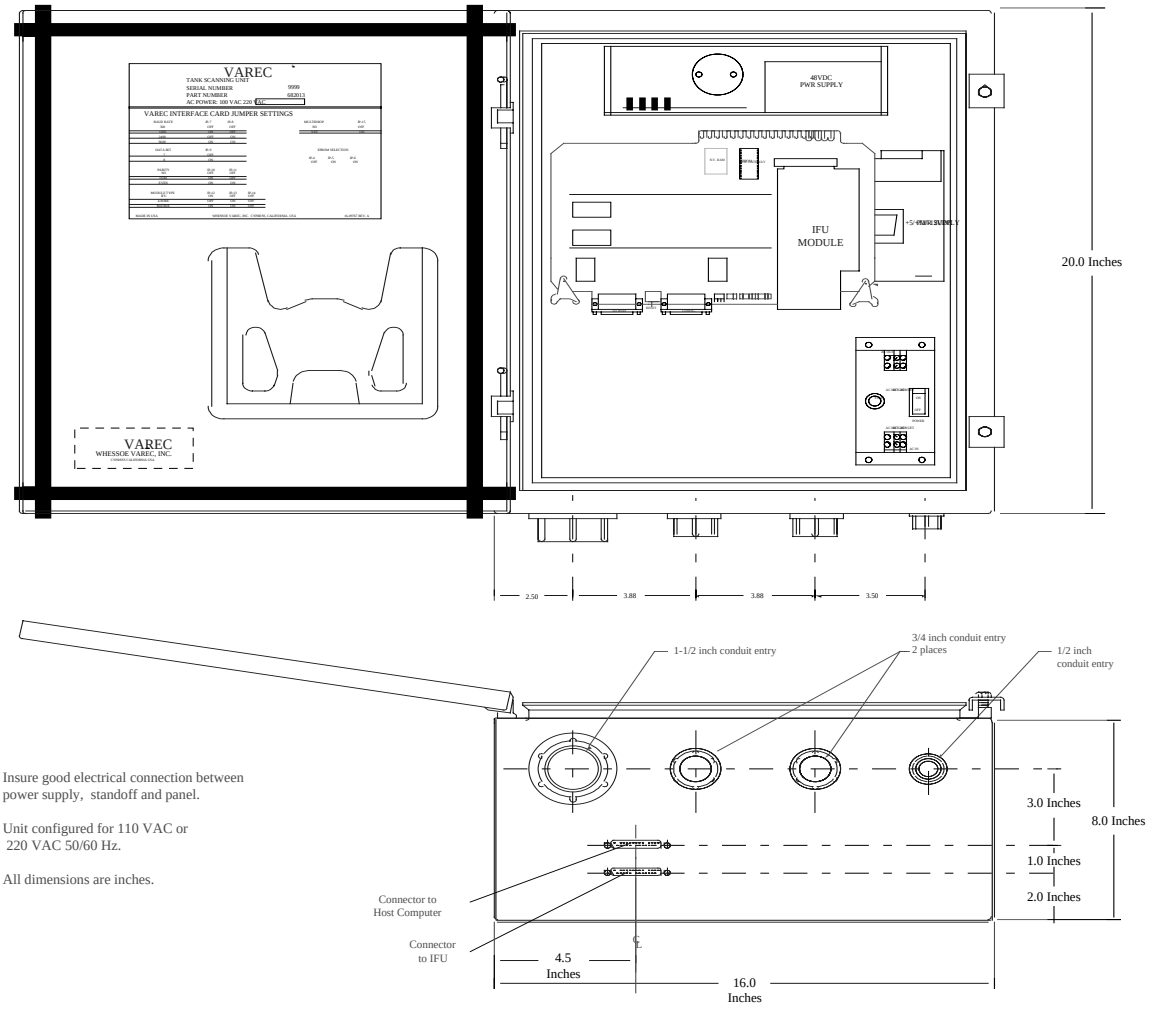


Figure 1-1 Varec 6820 Series Tank Scanning Unit (4-Wire & Matrix)



Insure good electrical connection between power supply, standoff and panel.

Unit configured for 110 VAC or 220 VAC 50/60 Hz.

All dimensions are inches.

Figure 1-2 Varec 6820 Series Tank Scanning Unit (IFU)

This page intentionally left blank.

SECTION 2 - INSTALLATION

Overview

The reliability and functionality of the Varec 6820 Series Tank Scanning Unit is dependent upon proper installation and location. Install the TSU to minimize vibration, shock and temperature fluctuations.

Configuration requirements for the TSU include jumper block settings for host serial port settings.

The software data base resides in NVRAM (Non-Volatile Random Access Memory) to prevent loss of data when power is turned off. Software data base configuration is accomplished in an off-line mode by use of the diagnostic program (DIAG 2000) operating in a host computer. The Gateway Utilities software permits a "back-up" of the data base.

The Whessoe Varec, Inc. diagnostic program is DOS based and executed on a computer. Operator commands are available to configure and modify the data base, and include:

- Add a Tank (AT)
- Display a Tank (DT)
- Remove a Tank (RT)
- Initialize (ID)
- Terminate Operator Input (EX)
- Display All (DA)

The Run Diagnostic Tests (TS) function is not operational and should not be used.

Commissioning

The Varec 6820 Series Tank Scanning Unit can be commissioned either before or after installation. Whessoe Varec, Inc. recommends commissioning the TSU on the test bench prior to installation. This ensures that all TSU components are functioning correctly and provides the user with operational experience.

Equipment Checklist

After unpacking, verify receipt of the applicable items.

Standard Equipment

- Varec 6820 Series Tank Scanning Unit
- Instruction manual (P/N 33-09247)
- TSU to computer serial cable (50 ft) (P/N 120-02-073)
- Eight-foot power cord (P/N P108-07-003)
- Varec Diagnostics disk, DIAG 2000 (P/N 49-08528)

Optional Equipment

- Varec Gateway Utilities Program (P/N 49-09262)

Jumper Block Settings

There are several groups of jumpers on the Gateway board assembly that are used for configuration. The board must be configured for the type of interface module (4-wire, matrix or IFU) and for the serial data communications format. Refer to Figure 2-1, Jumper Block Locations for JP1-J22.

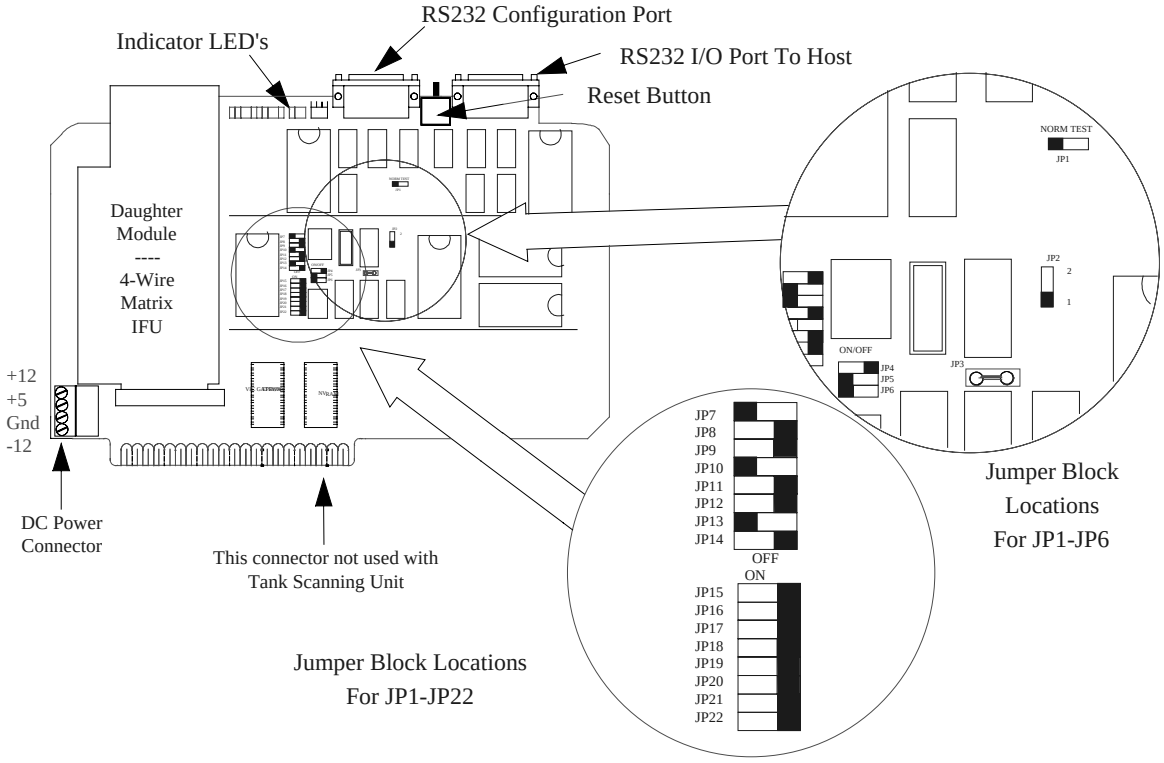


Figure 2-1 Jumper Block Locations

Conventional tank gauging jumper block settings. Do *not* change the state of the following switches.

JP1	NORM
JP2	1
JP3	Wire Jumper Installed
JP4	OFF
JP5	ON
JP6	ON

Serial data communications format jumper block settings:

JP7	**JP8**	**Baud Rate**	
OFF	OFF	300	
ON	OFF	1200	(Factory default)
OFF	ON	2400	
ON	ON	9600	

JP9	**Data Length**	
OFF	7 bits	(Factory default)
ON	8 bits	

JP10	**JP11**	**Parity**	
OFF	OFF	None	
ON	OFF	Odd	(Factory default)
OFF	ON	not used	
ON	ON	Even	

Daughter board module jumper block settings:

JP12	**JP13**	**JP14**	**Module**
OFF	ON	OFF	4-Wire
ON	OFF	OFF	IFU
ON	ON	OFF	Matrix

Custom or special operating modes of the TSU jumper block settings. (Normally OFF)

JP15	OFF	Multidrop Mode
JP16 - JP22	OFF	

4-Wire Transmitter Wiring

For a 4-wire transmitter gauging system, connect a 4-wire transmitter to the TSU as shown in Figure 2-2, Wiring with 4-Wire Transmitters. Wiring is identical for use with 4-Wire Servo Gauges. The wiring is also similar when wiring the Varec Model 4100 Multifunction Transmitter (MFT). When using the MFT care should be given to the power consumption of the transmitters. Each MFT draws about 30 mA, and possibly more depending on the number of HART devices attached to the MFT. It is possible to exceed the 3 Amp maximum load available.

Following are examples of wiring with Series 1900 4-Wire Transmitters, Model 4100 Multifunction Transmitters, Model 6500 Servo Gauges and Model 6603 Tankside Receivers.

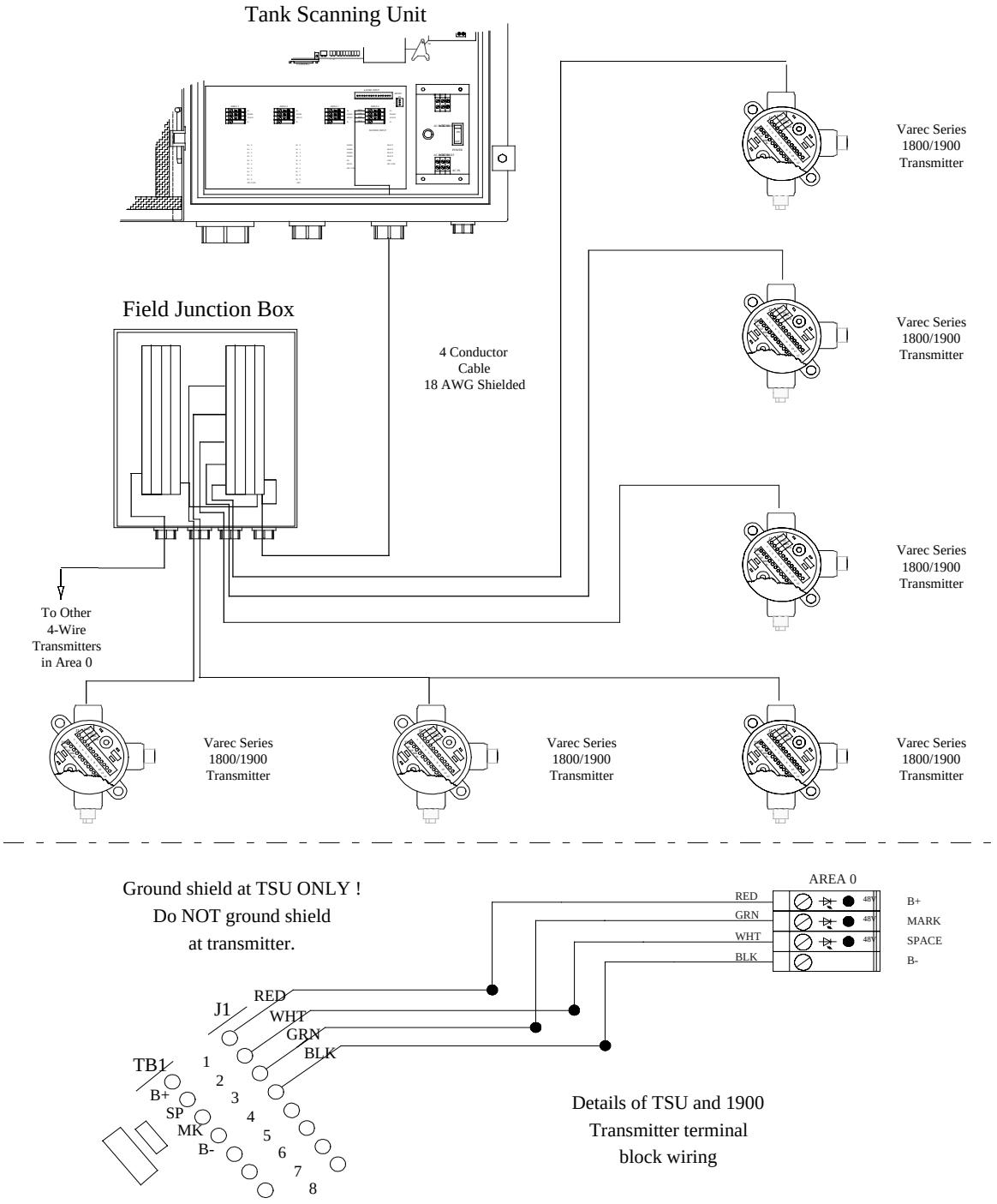


Figure 2-2 Wiring with 4-Wire Transmitters

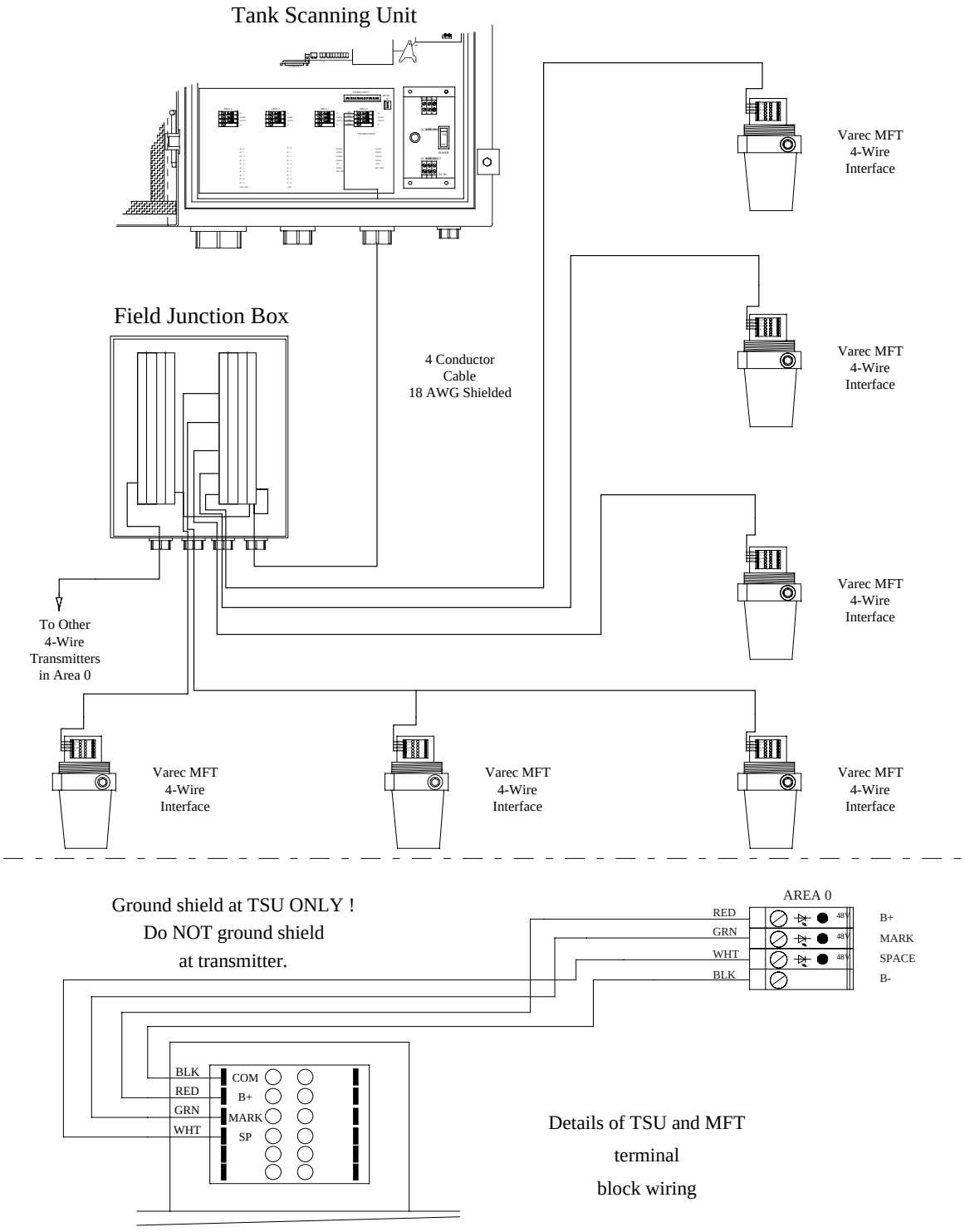


Figure 2-3 Wiring with Multifunction Transmitters

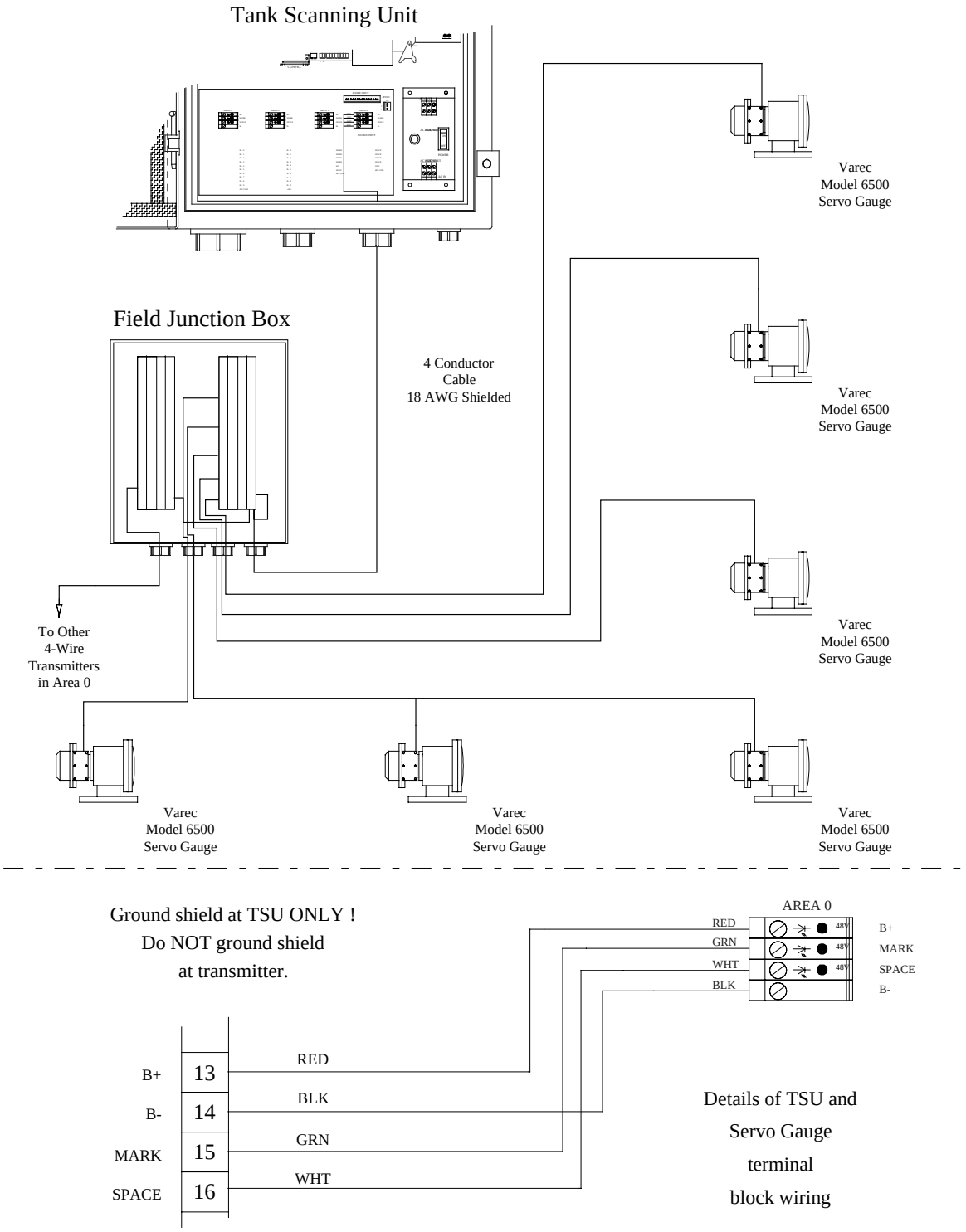


Figure 2-4 Wiring with Servo Gauges

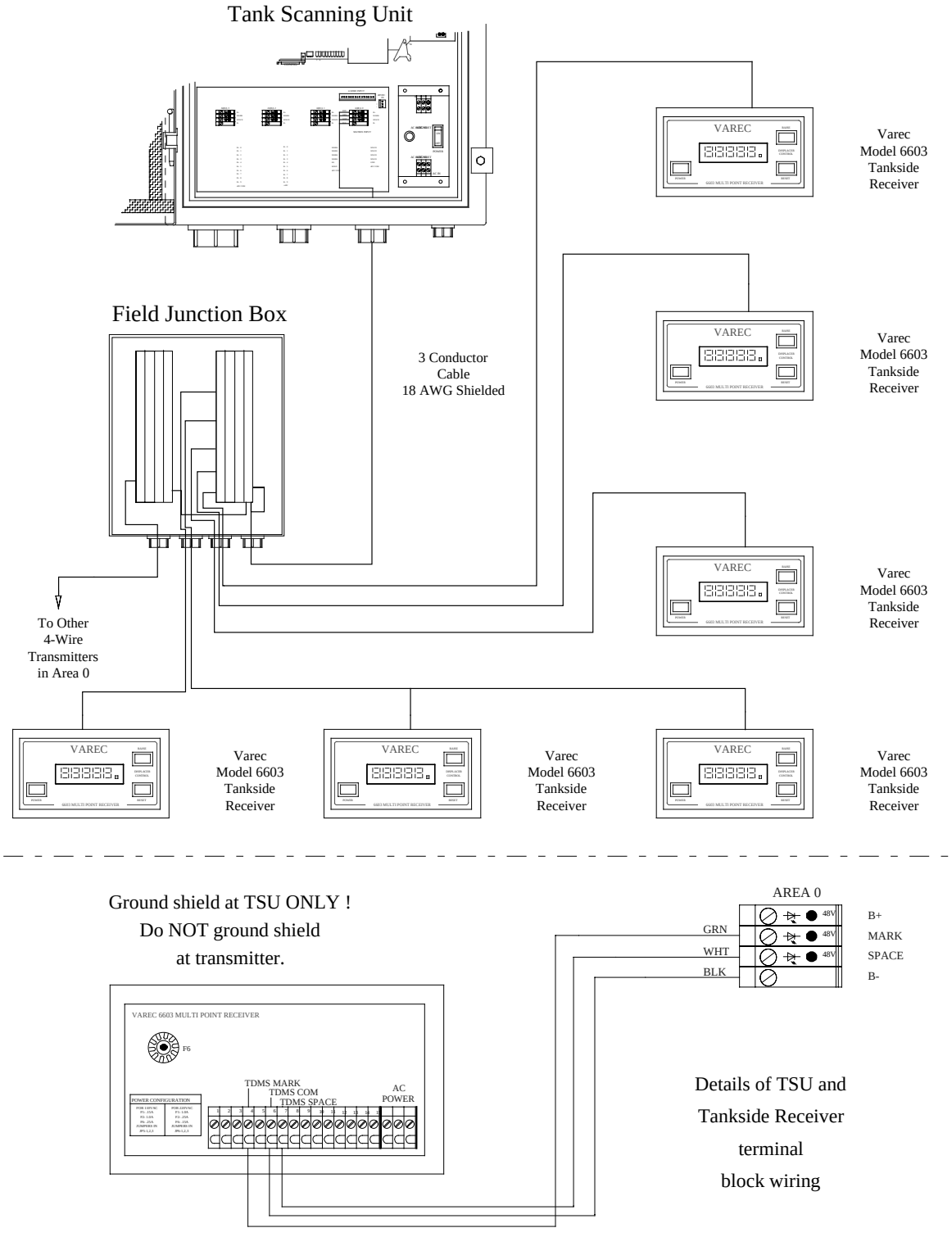


Figure 2-5 Wiring with Model 6603

Matrix Transmitter Wiring

For a matrix transmitter gauging system, connect the matrix transmitters to the TSU as shown in Figure 2-6, Wiring with Matrix Transmitters. A maximum of 100 matrix transmitters can be connected.

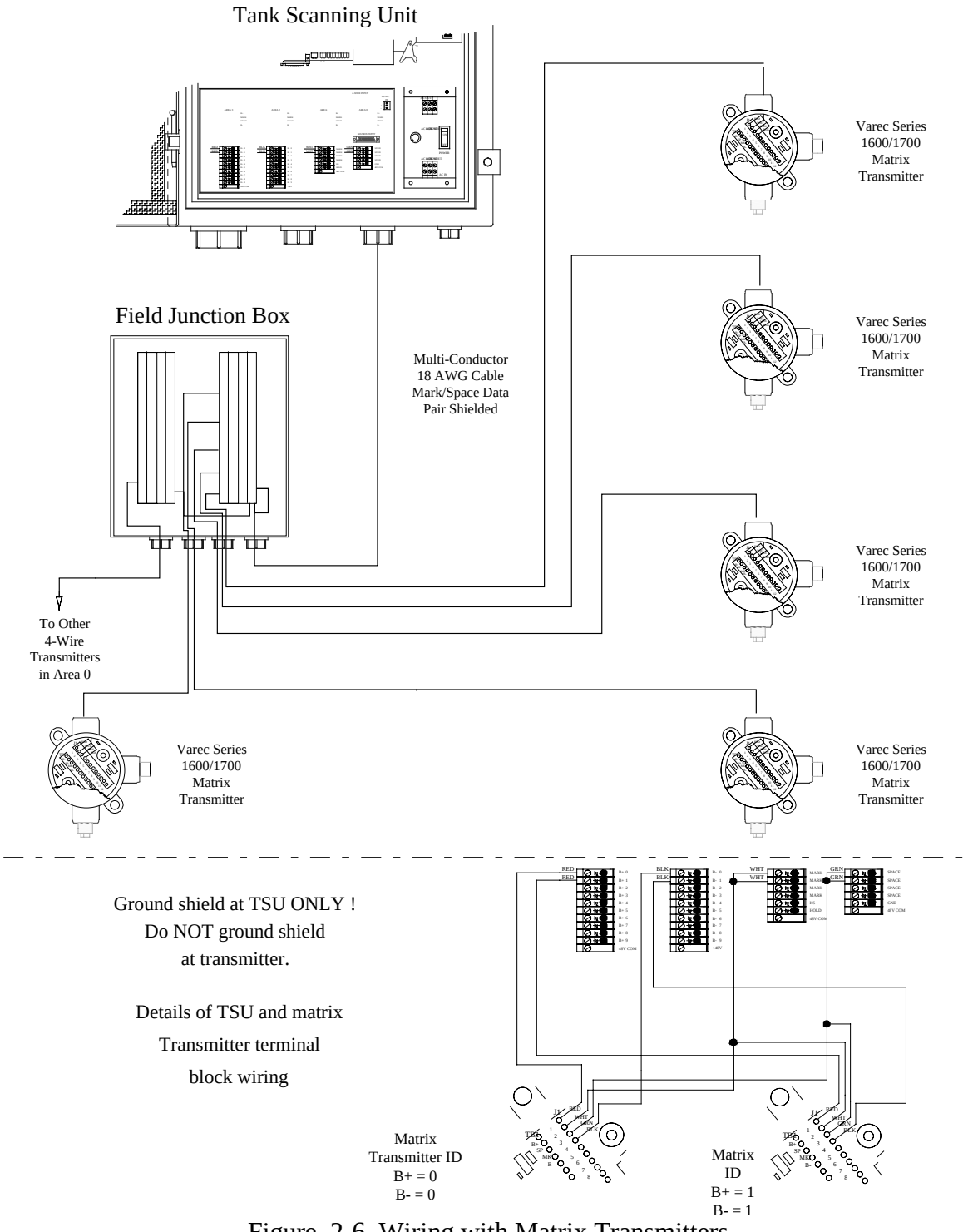


Figure 2-6 Wiring with Matrix Transmitters

TSU to Computer Communications

Connect the supplied cable between the TSU and the serial communication port of the host computer. Figure 2-7 shows the wiring diagram of the 25-pin to 25-pin cable. If the computer has a 9-pin RS-232 connector an adapter is required. It is very important that the shield of the cable be connected to pin 1 on both ends of the cable.

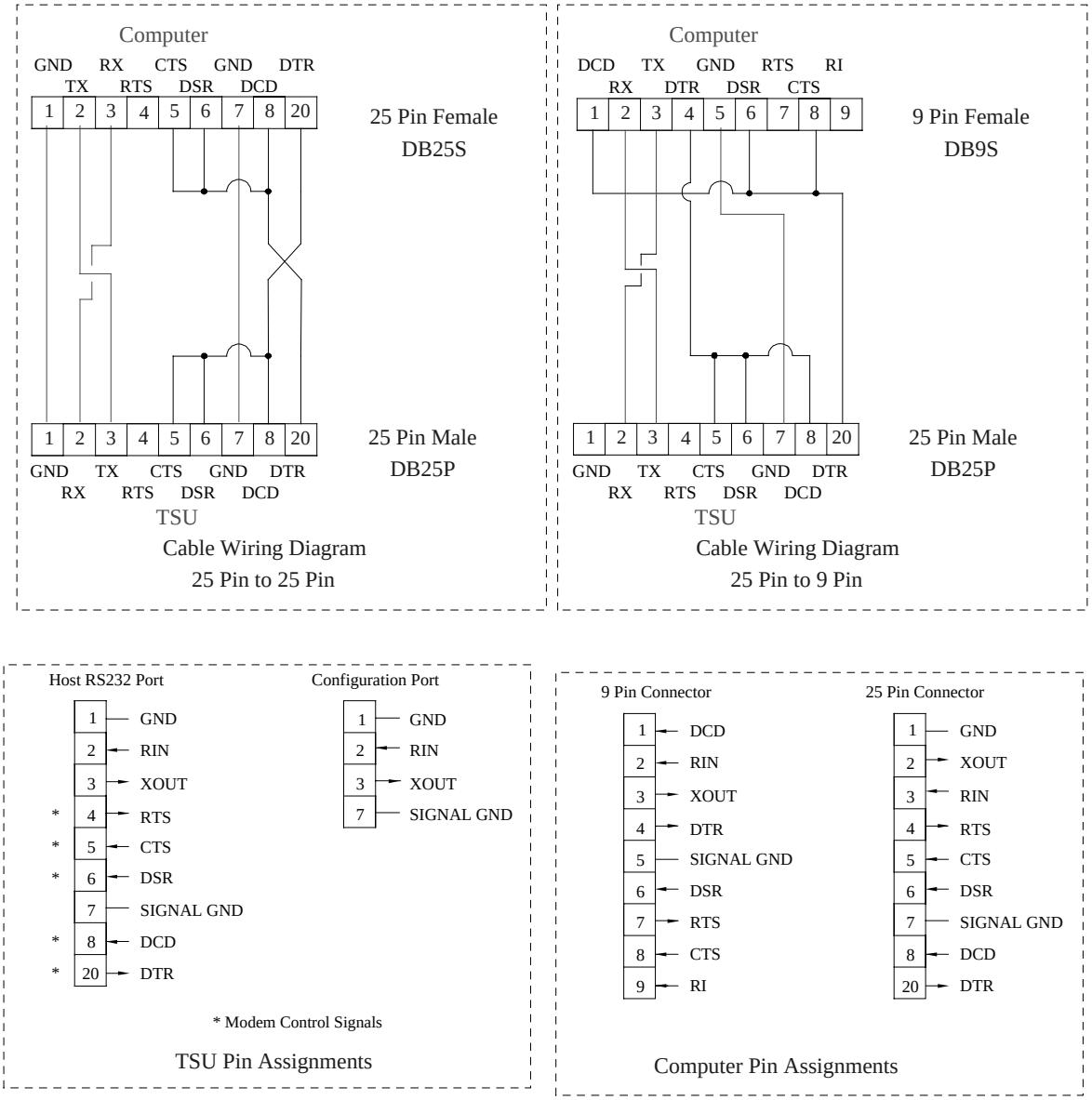


Figure 2-7 RS-232 Cable

TSU to Modem Communications

The TSU can be connected to a line driver or modem. This allows location of the TSU at a remote site from the computer. The supplied cable is not designed for this connection. The wiring of the cable will depend on the communications device used. Usually pins 1-8 and 20 are required to set all the necessary handshake lines.

The TSU is a DTE device and can be connected directly to another DCE device, such as a modem. The TSU operates in half-duplex mode. CTS and RTS must be asserted (high) before the TSU will communicate. If CTS (pin 5) and RTS (pin 4) are not connected, pull-up resistors in the TSU will hold the signals high.

Figure 2-8 shows a wiring diagram example of a 25-pin to 25-pin TSU to modem cable.

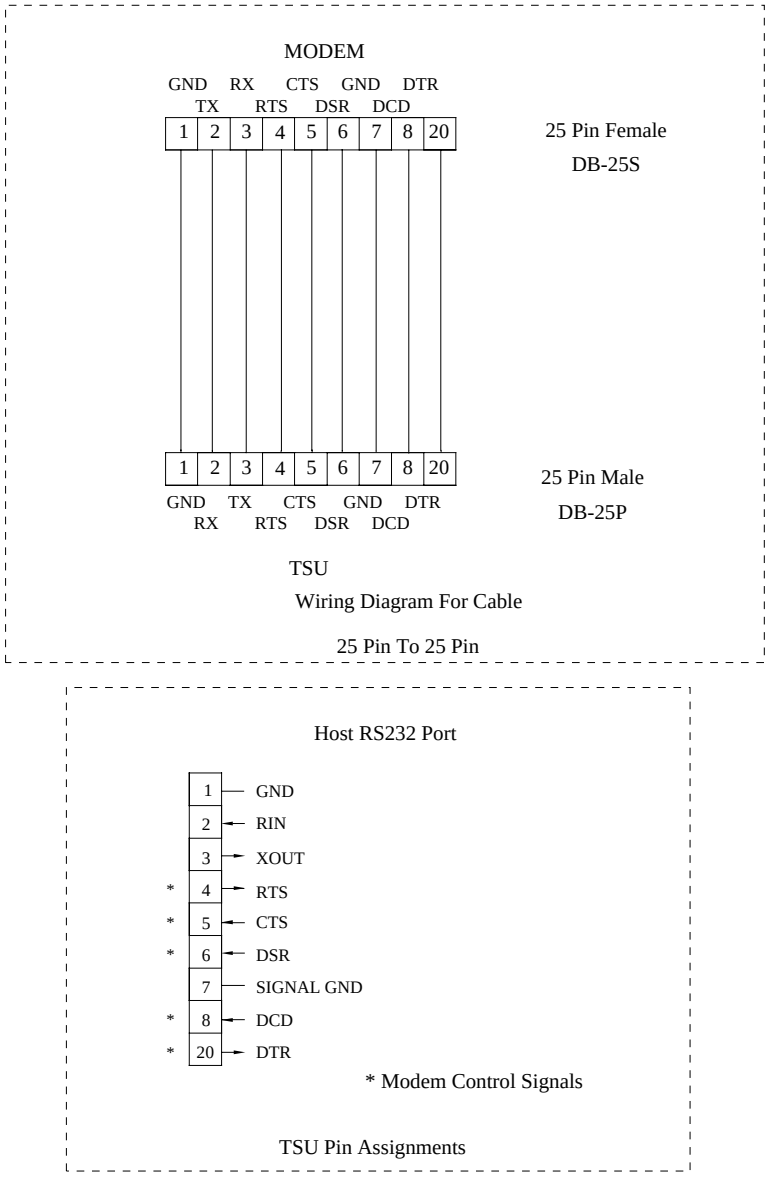


Figure 2-8 RS-232 Modem Cable

Starting the System on the Test Bench

Connect AC power to all test bench system equipment and turn on all power switches. The power cord is included with the TSU to facilitate bench starting. Connect the black wire to AC HOT, white wire to AC NEUT, and green wire to AC GND. For 220 VAC applications be sure and follow local electrical codes. Figure 2-9 shows the details of the power panel assembly. The required fuse is 1 Amp for 110 VAC service and 2 Amp for 220 VAC service. The part numbers for these fuses are shown in *Recommended Spare Parts* in Section 5, *Specifications and References.*

Loading the Varec Diagnostic Software

Copy the files from the DIAG 2000 Diskette onto the computer. DIAG can reside in the TankView or System IV disk directory. Execute the DIAG program by entering **DIAG** followed by <**Enter**>. Set the communications ports to the required baud rate and other parameters.

Entering the TSU Configure Mode

From the main DIAG menu, type a **d** to select terminal mode. This mode allows interactive communication with the TSU from the computer keyboard. The default communications parameters are COMM PORT 1, BAUD RATE - 1200, DATA BITS - 7, PARITY - ODD and STOP BITS - 1. These can be changed by using the <F2-SETUP> key.

The computer is now essentially a "dumb" terminal and any data appearing at the lower left corner of the screen is from the TSU.

Type **#T** followed by the <**Enter**> key. The screen should scroll and display the current EPROM revision and a help prompt.

```
VIC/GATEWAY VERSION x.xx

ENTER ?? FOR HELP
```

Enter **??** to display the commands available as follows:

```
AT      ADD A TANK TO THE DATA BASE
DT      DISPLAY A TANK IN THE DATA BASE
RT      REMOVE A TANK FROM THE DATA BASE
EX      TERMINATE OPERATOR INPUT
ID      INITIALIZE (ZERO) THE DATA BASE
DA      DISPLAY ALL
TS      RUN DIAGNOSTIC TESTS
```

Type **ID** followed by the <**Enter**> key to initialize the data base, thus clearing the NVRAM (Non-Volatile Random Access Memory) of all data. The tank configuration table in the TSU is now clear and ready to be configured.

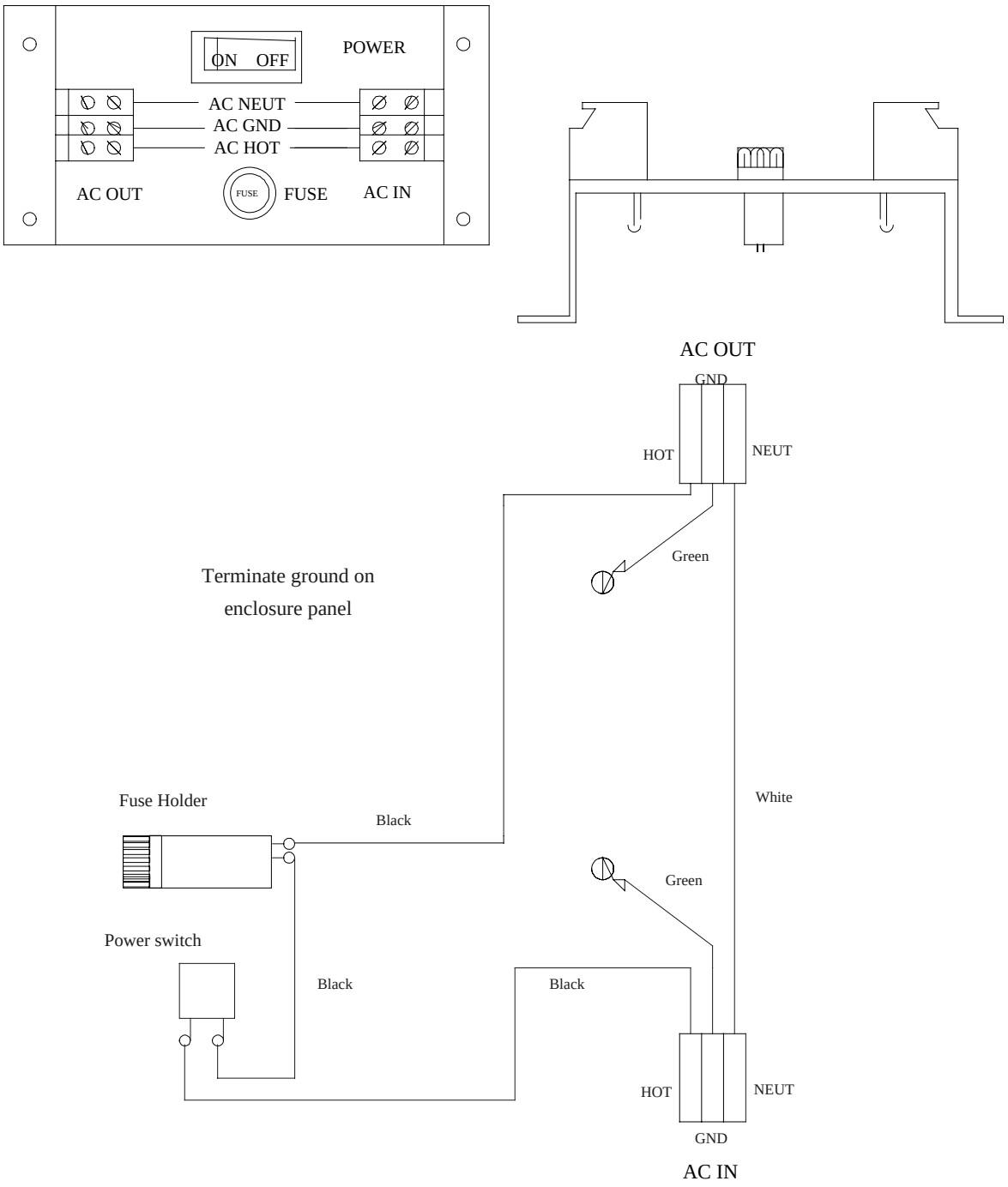


Figure 2-9 Power Panel Assembly

Configuring a Tank

Type the Add Tank command **AT** followed by the <**Enter**> key. Enter **1** for the tank ID and then continue to answer the screen questions about the type of transmitter and transmitter interface used. Refer to Appendix A, *Software Configuration*, for detailed information on programming the Varec 4-Wire, IFU, and Matrix modules.

Only one tank is configured for the bench test. At the DO YOU WANT TO ADD ANOTHER TANK (Y OR N)? prompt, type **N** followed by the <**Enter**> key to terminate the single tank configuration sequence. Type **EX** followed by the <**Enter**> key to put the Gateway board in the on-line mode. Press <**Esc**> to return to the main menu.

Gauging a Tank

From the main menu, type a **4** to enter the TSU communication mode. The diagnostic software now functions as a host computer and tests communication with the TSU by sending command codes to the TSU and verifying their acknowledgment.

Wait several seconds, then observe the communication status in the upper right corner of the display area. Change ID to **001** before gauging. When the status reads **OK**, type **G** to initiate a continuous poll of the selected transmitter. The data received from the polled transmitter is displayed on the screen.

If pins 1 and 2 are connected together on the encoder connector on the 1900 transmitter board, the level is 0 ft. - 11 inches - 15/16 inch. If the pins are not shorted, then you must know the current position of the encoder or you will not know if the display is correct.

Terminating the Test

To terminate the test, press the <**Esc**> key twice. Turn off power to all equipment and disconnect all test wires and cables. The TSU is now ready for permanent installation.

Mechanical Installation

The Varec 6820 Series Tank Scanning Unit is designed to be wall mounted. The basic overall dimensions relative to installation are indicated in Figure 2-10, Basic Installation Dimensions.

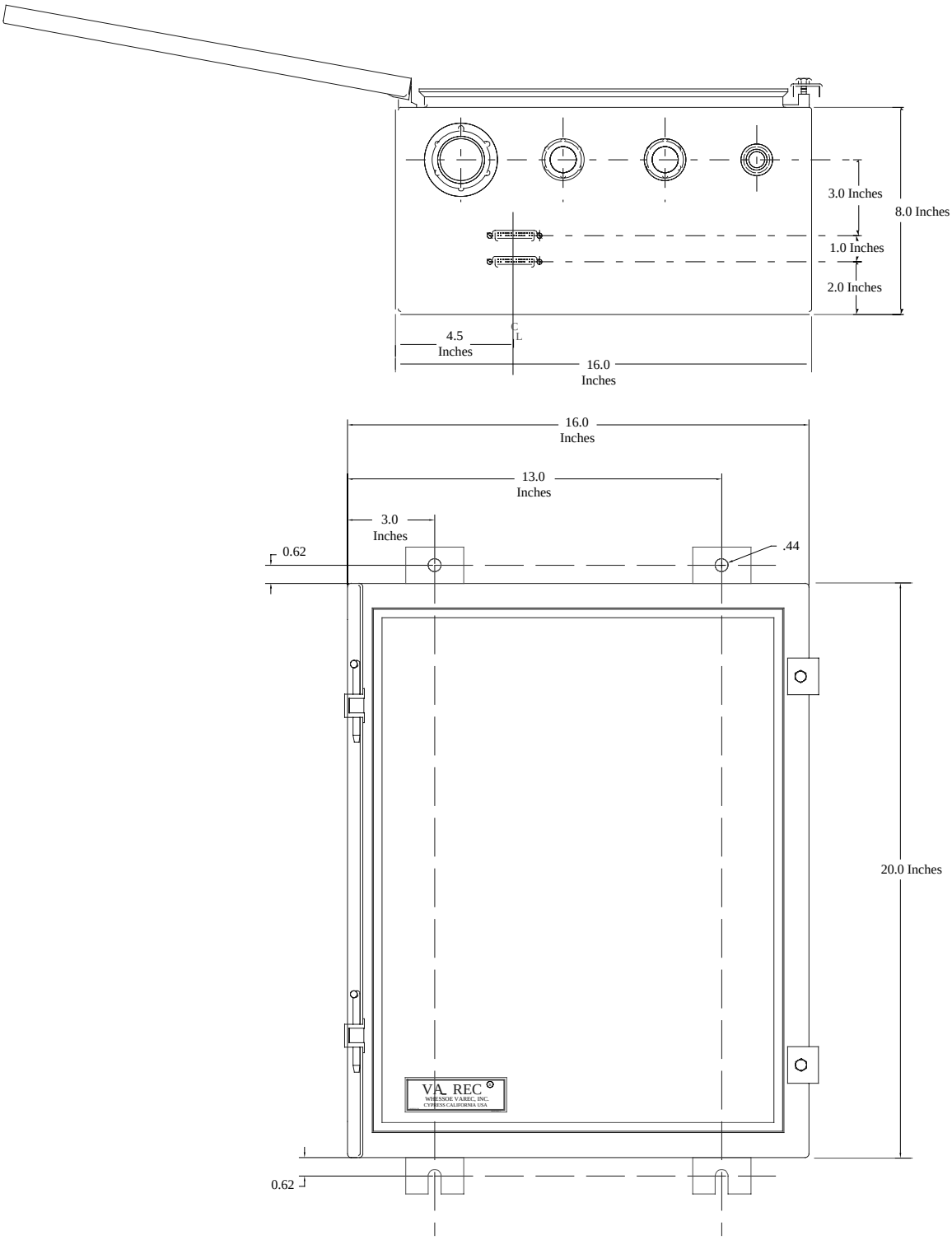


Figure 2-10 Basic Installation Dimensions

Environmental

Mount the TSU to minimize ambient temperature changes. The ambient temperature operating range of the TSU is +32 to +158 ºF (0 to 70 ºC). In addition, mount the TSU to avoid vibration, shock and any contact with corrosive atmospheres.

Accessibility

When choosing a location for installation, take into account the requirement for access to the TSU. Wiring connections are made through the conduit hubs on the bottom of the housing. Mount the TSU so that the bottom of the housing is accessible for wiring or conduit tubing to be routed to the conduit hubs. There are two 3/4 inch and one 1-1/2 inch NPT threaded conduit hubs. Refer to Figure 2-10 for dimensional layout and assignment suggestions. Provide at least 17 inches (432 mm) of space in front of the TSU for access and service.

Mounting

The 6820 Series Tank Scanning Unit weighs 38 pounds (17.3 kg). This weight must be securely supported. Verify that the mounting-foot kit is installed according to the instruction sheet supplied with it. Mount the TSU to a panel, wall or equipment rack using four 5/16 inch (M8) bolts. Refer to Figure 2-10 for the mounting hole pattern and clearance around the unit.

Electrical Installation

All of the electrical connections to the Varec 6820 Series Tank Scanning Unit are made on the power panel located inside the enclosure. The primary AC fuse is located on the power panel. Be sure and replace the fuse with the same rating.

Uninterruptable Power Supply (UPS) Considerations

In many years of field experience, we have found that the use of an UPS with the gauging system greatly improves its reliability. In addition to providing constant power, the UPS provides transient over-voltage protection and ground termination. Large UPS systems that may be in place may not be suitable if they are powering equipment that generates noise or power surges. A separate UPS that powers the gauging system exclusively is ideal. Refer to TSU, IFU (if used) and computer based display system (if used) specifications for sizing of the UPS for your requirements.

Wire and Cable Installation

To reduce the possibility of signal interference, route the transmitter wiring and the AC wiring through different conduit hubs located on the bottom of the unit. The computer and IFU cables connect to 25-pin connectors on the bottom of the unit. Reference Figures 2-2 through 2-6 for conduit and cable connector locations.

Conduit connections on the enclosure should be plugged and sealed to avoid moisture accumulation on the interior of the housing.

CAUTION

If the connections are not sealed, install the wiring with a drip loop. The bottom of the drip loop should be lower than the conduit connections or the TSU enclosure.

System Grounding Considerations

Proper grounding of the gauging system components is crucial to the reliability of the system as a whole. The grounding technique used must minimize the ground potential difference between the components and not introduce or allow ground currents to flow. Figures 2-11 and 2-12 show recommended ground connections for different system configurations.

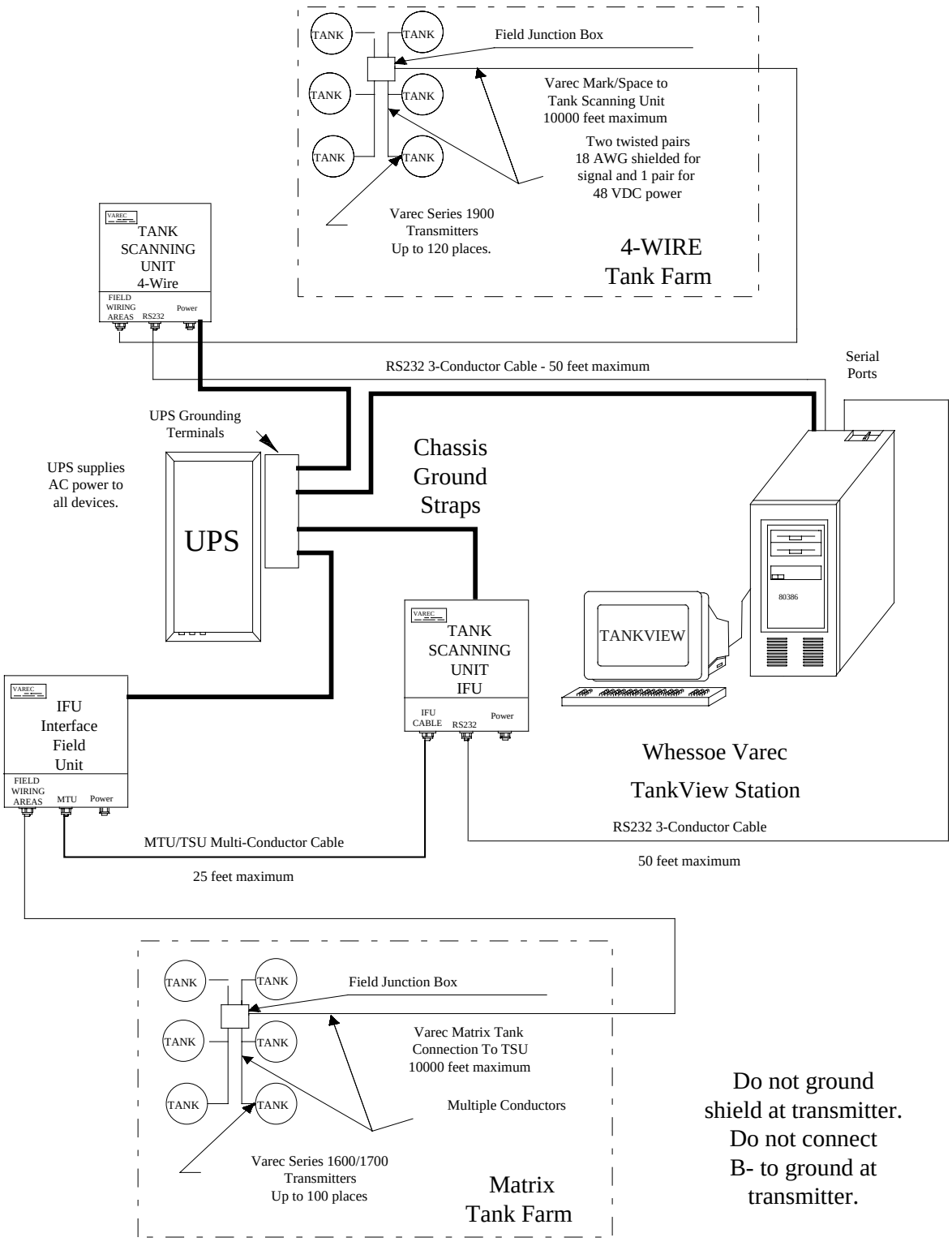


Figure 2-11 Proper System Grounding With UPS

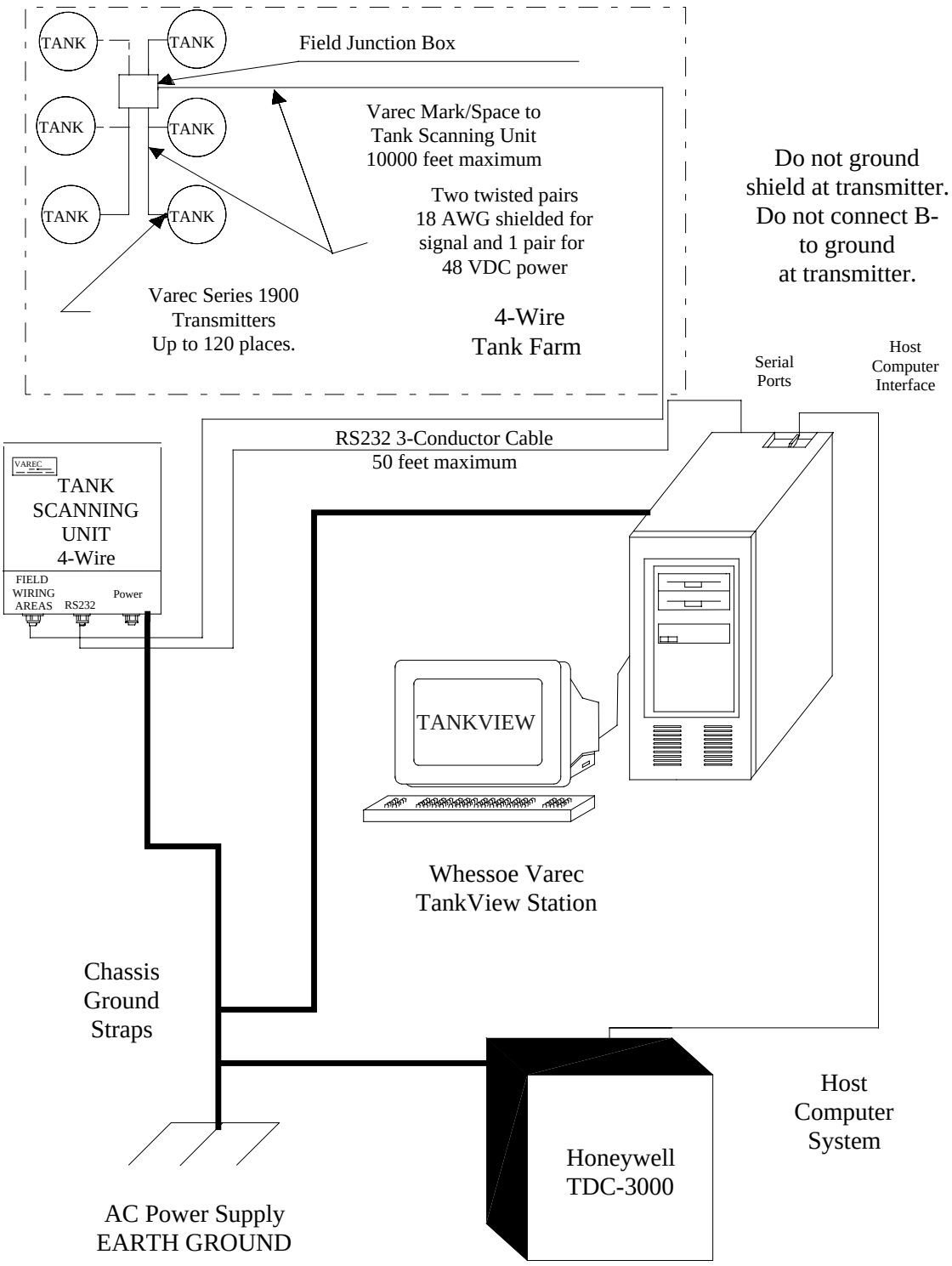


Figure 2-12 Proper System Grounding With Host Computer

4-Wire Transmitter Wiring Considerations

The method of field wiring between the TSU and the 4-wire transmitters has a considerable impact on system performance. Wiring problems are the main cause of system faults.

The 4-wire TSU supports up to a total of 120 4-wire transmitters distributed over four separate groups called areas. While it is possible to connect all 120 4-wire transmitters to a single area, the resulting large physical size of this single data bus makes the gauging system particularly susceptible to total failure due to wiring faults, lightning or damaged 4-wire transmitters. Whessoe Varec, Inc. recommends not more than 25 transmitters be connected to any single area.

When practical, the 4-wire transmitter configuration should be split into four small groups and connected to the four areas provided. Each area has surge and transient protection. The TSU termination board connections have built-in LED indicators that show activity. This feature greatly aids troubleshooting.

Use the following installation guidelines:

- All 4-wire transmitters connected to the same area must have a unique address setting. Refer to the Varec 1800 or 1900 Series 4-Wire transmitter manual for details.
- Limit the number of 4-wire transmitters on any area to 25 or less.
- Use 18 gauge wire or larger.
- Limit the distance from the 4-wire transmitter to the TSU to under 10,000 feet.
- Use shielded twisted-pair wire for power and communication lines.
- Ground all shields at one location at the TSU. *Do not* ground the shield in the field.
- Use wire with an insulation rating of 300 V or greater.
- *Do not* run the transmitter power or data wires in the same conduit with AC power lines.
- Avoid aerial wiring.
- The use of field junction boxes is recommended to facilitate field wiring. The junction boxes should contain terminal strips that have isolation switches. This permits easy troubleshooting of field transmitter problems.

Every gauging system is unique, and the guidelines listed above are general in nature. For a detailed evaluation of an existing or proposed installation, contact Whessoe Varec, Inc.

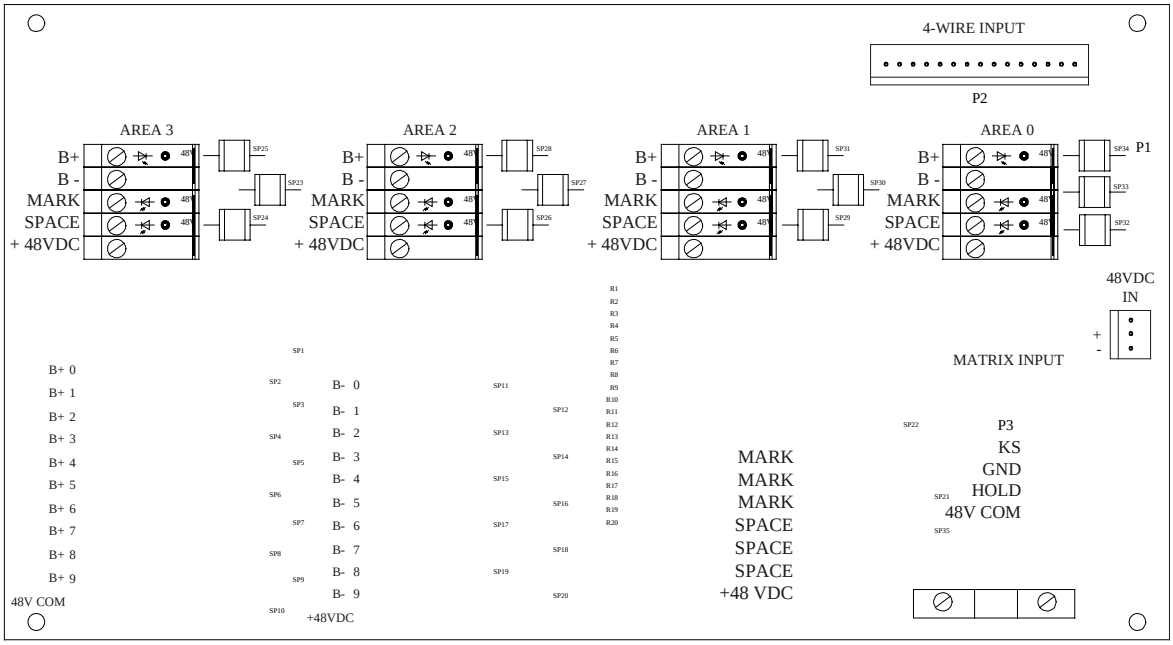


Figure 2-13 4-Wire Termination Board Assembly

Matrix Transmitter Wiring Considerations

The method of field wiring between the TSU and the matrix transmitters has a considerable impact on system performance. Wiring problems are the main cause of system faults.

The 4-wire TSU supports a maximum of 100 matrix transmitters on the B+ and B- selection lines. These connections form a 10 by 10 matrix. All matrix transmitter Mark/Space data lines are connected in parallel. If the customer has an existing 1682 Temperature Converter, it connects to the three-wire RTD output in parallel on all transmitters. The "G" feature relay on the transmitter completes the RTD circuit when the transmitter is selected. Note that the 1682 Temperature Unit is obsolete and no longer supported by Whessoe Varec, Inc.

Use the following installation guidelines:

- Use 18 gauge wire or larger.
- Limit the distance from the transmitters to the TSU to under 10,000 feet.
- Use shielded twisted-pair wire for power and communication lines.
- Ground all shields at one location at the TSU. *Do not* ground the shield in the field.
- Use wire with an insulation rating of 300 V or greater.
- *Do not* run the transmitter power or data wires in the same conduit with AC power lines.
- Avoid aerial wiring.
- The use of field junction boxes is recommended to facilitate field wiring. The junction boxes should contain terminal strips that have isolation switches. This permits easy troubleshooting of field transmitter problems.

Every gauging system is unique, and the guidelines listed above are general in nature. For a detailed evaluation of an existing or proposed installation, contact Whessoe Varec, Inc.

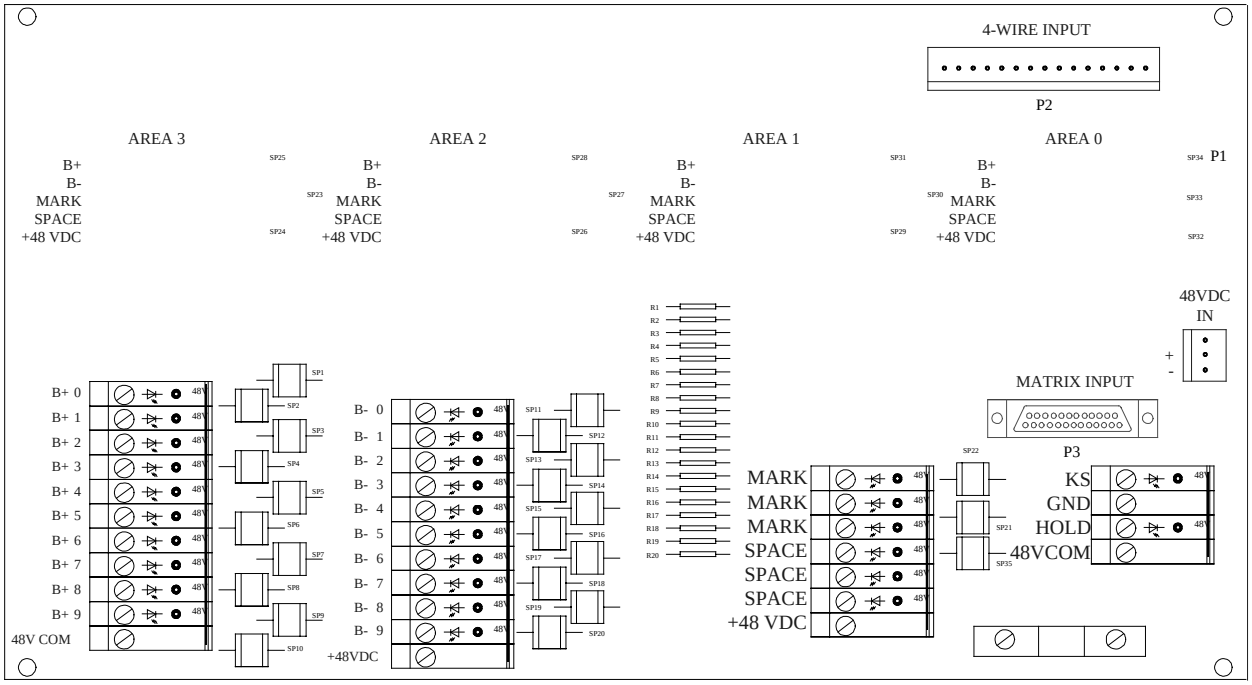


Figure 2-14 Matrix Termination Board Assembly

IFU Wiring Considerations

The IFU connects to the TSU with the same cable connecting it to the MTU. The 25-pin connector is found on the bottom of the TSU housing. An internal cable connects the IFU daughter module to the connector. There is no termination board required in the IFU configuration. Existing field wiring terminates at the IFU and need not be altered when the system is upgraded with the TSU.

Termination Board Wiring

All field wiring for 4-wire and matrix type transmitters are made on the termination board. The board is manufactured with the necessary parts for 4-wire or matrix. It cannot be built for both. Figure 2-15 shows the wiring schematic diagram for the termination board. Most wiring terminals have a built-in LED to show activity.

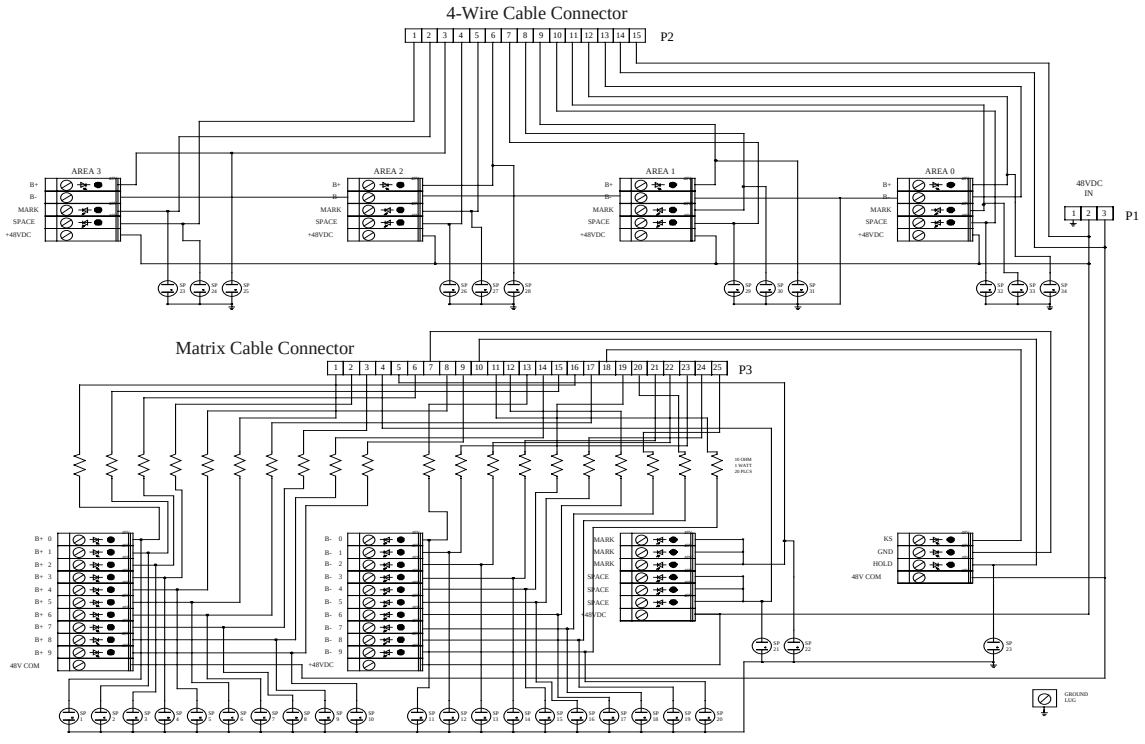


Figure 2-15 Termination Board Schematic

Termination Board Pin Assignments

P1 - Power Connector

1	Earth Ground
2	+ 48 VDC
3	48 VDC Common

P2 - 4-Wire Connector

1	Space - Area 3
2	Mark - Area 3
3	B+ - Area 3
4	Space - Area 2
5	Mark - Area 2
6	B+ - Area 2
7	Space - Area 1
8	Mark - Area 1
9	B+ - Area 1
10	Space - Area 0
11	Mark - Area 0
12	B+ - Area 0
13	B- - 48 VDC Common
14	B- - 48 VDC Common
15	+ 48 VDC

P3 - Matrix Connector

1	B+5
2	B+3
3	B+7
4	Space
5	Mark
6	B+2
7	Ground
8	B+4
9	B+9
10	Hold
11	B-9
12	B-6
13	B-0
14	B+8
15	B+1
16	B+0
17	B+6
18	KS
19	B-4
20	B-8
21	B-3
22	B-2
23	B-1
24	B-5
25	B-7

System Installations

The TSU is only a part of any tank gauging system. Figures 2-16 shows some of the various ways the TSU is connected in a system. Please contact Whessoe Varec, Inc. for detailed drawings for specific applications.

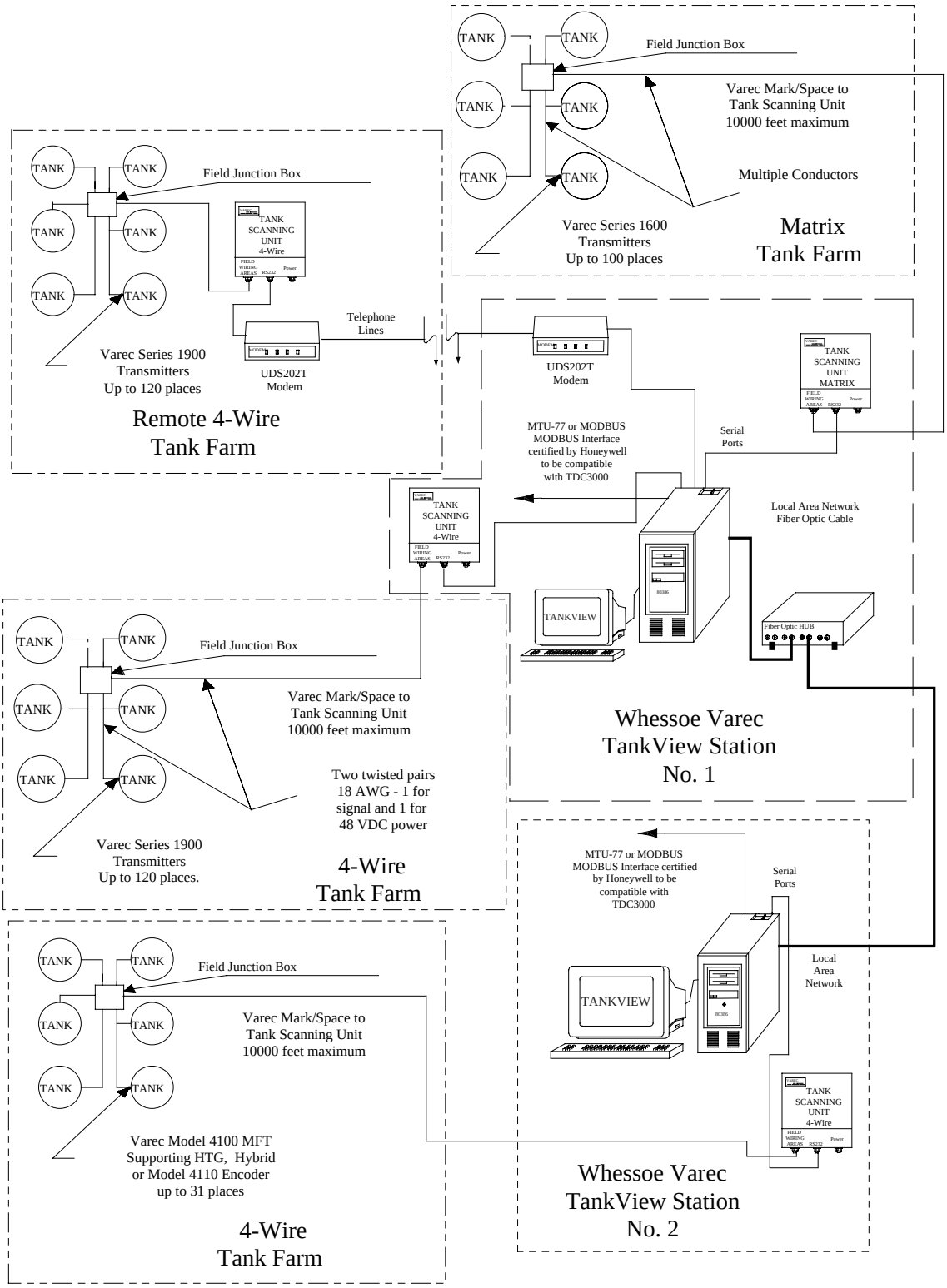


Figure 2-16 TSU Applications

SECTION 3 - OPERATION

Overview

The Varec 6820 Series Tank Scanning Unit operates as a slave to a host computer and polls a specific transmitter upon request. The computer running Varec TankView or Varec System IV Tank Gauging software is typically the host computer.

TankView or System IV may be interfaced to a higher level host computer, such as a Plant MIS or DCS, supporting asynchronous serial communication on a RS-232 electrical interface. The host computer can also interface directly to the TSU.

Host and TSU Communication

The message format of commands from a host computer interfaced directly to the TSU consists of ASCII characters beginning with "#" and ending with a Carriage Return. The message format of TSU responses to host commands consists of ASCII characters beginning with "@" and ending with a Carriage Return and Line Feed sequence.

Host Command	Definition	TSU Response
#&	Enable Echo Mode	Error Only
#*	Disable Echo Mode	Error Only
#0	Reset the TSU	Error Only
#10ttt56	Poll Tank	Current Data
#2	Send Current Status	@A or Error
#4	Enable Repeat Mode	Error Only
#5	Enable Convert Mode	Error Only
#6	Enable Format Mode	Error Only
#7	Enable Diagnostic Mode	Error Only
#V	Send Software Version Number	@VERSION # xx.xx
#Sf....f	Set Flag(s)	@S/Cf
#Cf....f	Clear Flag(s)	@S/Cf

Where:
f = Flag(s) to Set or Clear
ttt = Tank ID with leading zeros
x = 0 for Servo Gauge Reset
x = 1 for Servo Gauge Raise Displacer

Any number of the following flags can be set or cleared in one command line:

Flag	Definition
B	Send Back Data in Both Modes
C	Send Back Data in Convert Mode
D	Send Back Data in Diagnostic Mode
E	Echo Host Requests
F	Send Back Data in Format Mode
R	Repeat Mode on Data Requests
X	Send Back Expanded Error Messages

Note

While multiple flags can be specified in the set and clear flag commands, each flag set or cleared results in an individual TSU response.

When the repeat mode (Command #4) or any of the data format modes (Commands #5, #6, and #7) are established by host commands, the corresponding set or clear flag commands are inoperative until the TSU is reset by Command #0.

Command #8 returns current data only when x=1 (raise servo gauge displacer).

TSU Error Responses to Host Commands

Any of the following error codes can be returned by the TSU in response to a host command. An expanded error message is returned whenever the X flag (Send Back Expanded Error Messages) is set.

Error Code	Expanded Error Message
@?	HOST COMMUNICATIONS ERROR
@B	CAN NOT PROCESS HOST REQUEST
@C	INVALID HOST REQUEST
@D	BAD HOST REQUEST DATA
@E	EXCESS TRANSMITTER MESSAGE (TOO MANY BITS)
@F	INVALID INTERFACE TYPE
@G	INVALID TANK NUMBER
@H	INVALID TANK DATA BASE DATA ENCOUNTERED
@I	INCOMPLETE TRANSMITTER MESSAGE (NOT ENOUGH BITS)
@J	OTHER VAREC I/O ERROR
@N	TRANSMITTER RESPONSE TIME-OUT
@P	NO 48 VOLT POWER OR CIRCUIT FAILURE
@X	TRANSMITTER MESSAGE PARITY ERROR

TSU Data Responses to Host Commands

Tank data is returned by the TSU to the host computer in one or more of several available data formats, depending on which formats have been selected. The units (English Fractional, English Decimal, or Metric) of the data returned is determined by how the transmitter is programmed in the TSU during software configuration. The available formats and associated flag settings are as follows:

Data Format	Flags Set
Raw or Normal	None
Diagnostic	D
Converted	C
Formatted	CF
Raw and Converted	BC
Raw and Formatted	BCF

Raw or Normal Data Format (No Flags Set)

@XXXXXX.....X For the number of bits requested, where X is a hexadecimal digit.

Example:
@100010008003F4501

Diagnostic Data Format (Flag D Set)

@XXXXXX.....X TOTAL BITS= XX MARKS= XX SPACES= XX BAD= XX

Example:
@100010008003F4501 - TOTAL BITS=56, MARKS=13, SPACES=43, BAD=0

Converted Data Format (Flag C Set)

@WWYYZZ/ABSLFMNO	English Fractional
@CCCC /ABSLFMNO	English Decimal
@DDDDD /ABSLFMNO	Metric

Example:
@001115/** 1 450

Where:

WW	= feet
YY	= inches
ZZ	= sixteenths
CCCC	= hundredths of feet
DDDDD	= millimeters
A	= first alarm contact (0=open, 1=closed)
B	= second alarm contact (0=open, 1=closed)
S	= temperature sign (space is positive, - is negative)
L	= temperature hundreds
F	= not used
M	= temperature tens
N	= temperature ones
O	= temperature tenths

Formatted Data Format (Flags CF Set)

English Fractional
@TANK# 0YYY XX FT. XX-XX/16 IN. TEMP= SXXX.X STATUS= AB

English Decimal
@TANK# 0YYY XX.XX FT. TEMP= SXXX.X STATUS= AB

Metric
@TANK# 0YYY XX.XXX METERS TEMP= SXXX.X STATUS= AB

Example:
@TANK# 0001 00 FT. 11-15/16 IN. TEMP= 145.0 STATUS= **

Where:

YYY	= tank number
X	= numeric decimal data
S	= temperature sign (space is positive, - is negative)
A	= first alarm contact (0=open, 1=closed)
B	= second alarm contact (0=open, 1=closed)

Raw and Converted Data Formats (Flags BC Set)

See previous for format.

Example:
@100010008003F4501 001115/** 1 450

Raw and Formatted Data Formats (Flags BCF Set)

See above for format.

Example:
@100010008003F4501 TANK# 0001 00 FT. 11-15/16 IN. TEMP= 145.0 STATUS= **

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SECTION 4 - MAINTENANCE AND TROUBLESHOOTING

Maintaining the Tank Scanning Unit

The Varec TSU has been designed with high-reliability components. Dust and dirt should not be allowed to collect in the housing. The conduit entries should be inspected periodically to insure water does not itrude into the unit. All wiring connections should be examined for corrosion and all screw connections tightened.

It is recommended that the desired system configuration be verified when a problem occurs or when the configuration is in doubt. Refer to Section 2, *Installation*.

Troubleshooting the Tank Scanning Unit

For other than fuse replacement, it is recommended that all troubleshooting and repairs be performed by a factory trained service technician.

The input voltage fuse is located on the power panel. Replace the fuse as follows:

1. Disconnect the AC power cord from the AC source.
2. Unscrew the fuse holder.
3. Remove the defective fuse and discard.
4. Insert a fuse of the same value and rating.
5. Screw fuse holder back in place.
6. Re-connect the AC power to the AC source.

The 4-wire interface module has a fuse for each of the +48 VDC outputs for areas 0-3 as shown in Figure 4-1.

- Area 0 - F2
- Area 1 - F3
- Area 2 - F4
- Area 3 - F1

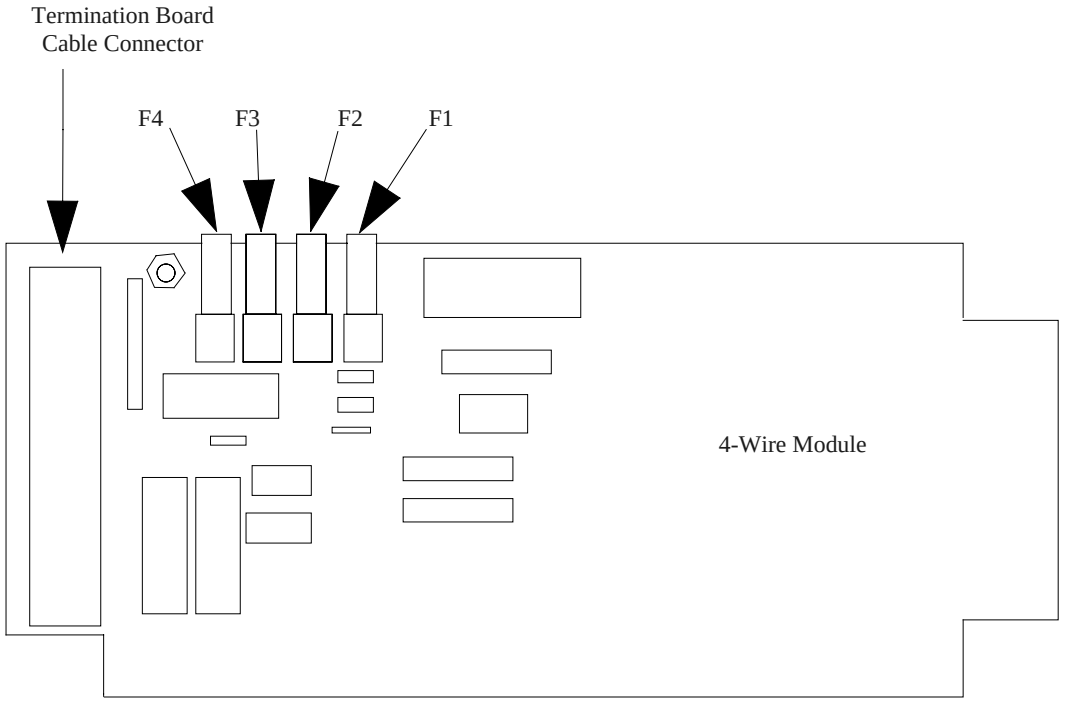

Figure 4-1 4-Wire Module Area Fuses

Startup Guide

Once the TSU is installed and the wiring is complete, final check-out and configuration of the system can begin. Startup of the installed system is essentially the same as the procedure *Starting the System on the Test Bench* described in Section 2, *Installation*.

The following steps provide a general outline of a TSU startup procedure:

1. Make a written record of the tank number, transmitter address, area and configuration information (level units and, if used, temperature units) for every transmitter connected to the TSU.

2. Set up the computer at the final location of the TSU. Load and configure the diagnostic software or Gateway Utilities Software.

3. Clear the configuration table in the TSU and enter the tank configuration data for the first tank.

4. Add the tank ID to the written record. The cross reference between the tank number and the tank ID stored inside the TSU is used later for configuring the host software. If possible, keep the TSU tank ID number the same as that of the transmitter ID. Repeat this procedure for all tanks and transmitters in the system.

5. Enter the TSU communication mode and gauge all tanks. When all transmitters report correct data, the TSU is ready to connect to the host computer.

Gateway Communications

The Gateway board communicates to the computer via Port 1, the RS232 I/O Port. Port 2 is used for configuration with the Varec System VI. The small red button located between the two port connectors is a reset button. It will initiate a software reset to the Gateway board and daughter module. Figure 4-3 shows the LED arrays found on the board. The LED array marked 7 through 0 is not used. The dual array next to Port 2 has the labels T and R. This stands for transmit and receive on Port 1. When the Gateway is operating and in communications with a host computer the LED will be blinking as data is transmitted and received. If the LED's are not blinking no communication is taking place.

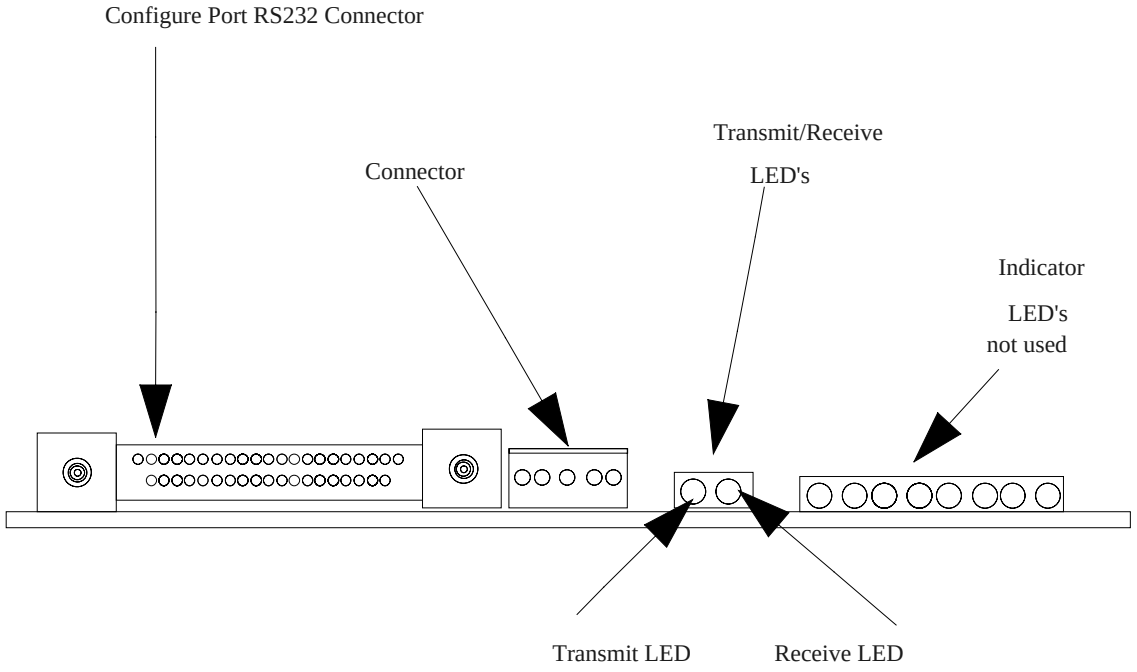

Figure 4-2 Gateway Board LED Indicators

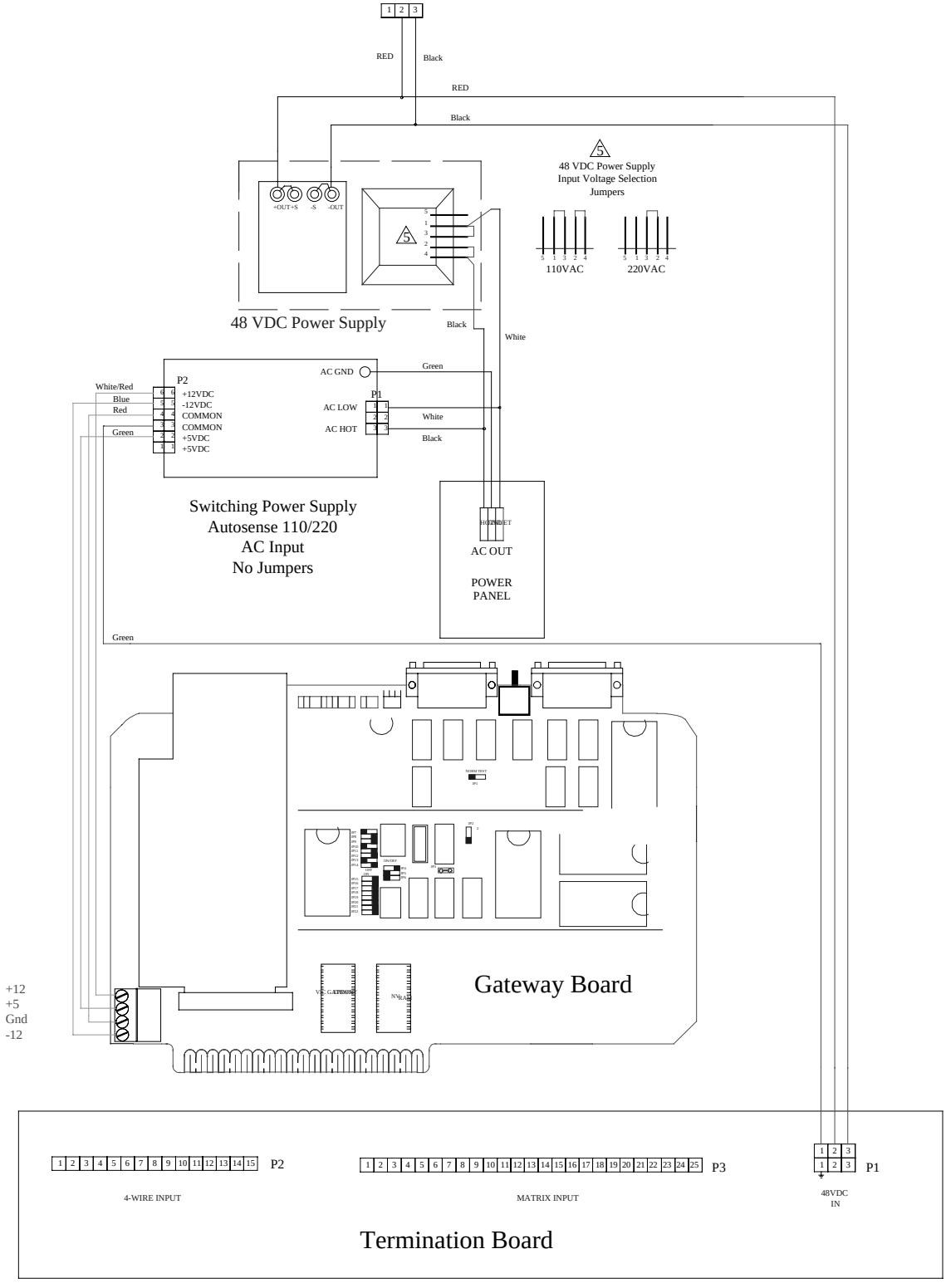

Figure 4-3 TSU Electrical Wiring Diagram

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SECTION 5 - SPECIFICATIONS AND REFERENCES

Recommended Spare Parts

The design of the Varec 6820 Series Tank Scanning Unit requires only a minimum number of spare parts be inventoried. It is not necessary to stock a quantity of spare parts equal to the number of tank scanning units in a given field. Review the service history for quantities selection.

Whessoe Varec, Inc. stocks spares for the Tank Scanning Unit. It is advised that the customer also maintains an inventory of critical items to minimize potential down time. Contact the Whessoe Varec, Inc. Product Service Group for further details. The following spare parts may be stocked:

Description	**Whessoe Varec, Inc. Part Number**
2-Amp Fuse (220 VAC)	P116-01-008
1-Amp Fuse (125 VAC)	P116-01-013
5/12/-12 Volt Switching Power Supply	P112-01-009
48-Volt Power Supply	P112-02-017
4-Wire Module	08-06841
Microfuse for 4-Wire Module	P116-01-026
IFU Interface Module	08-06844
Matrix Module	08-06847
Gateway Board	08-06859
Jumpers for Gateway	P108-38-017
Termination Board (4-Wire)	08-09774
4-Wire Termination Board Cable	06-09776
Termination Board (matrix)	08-09773
Matrix Termination Board Cable	P120-02-075
TSU/Host Communications Cable	P120-02-073
Internal 25 Conductor Cable	P120-02-074

Specifications and Physical Characteristics

Microprocessor:
Intel 8085

Clock Speed:
1.0 MHz

Serial Ports:
Two (EIA RS-232)

Port Configuration:
Data Base Configuration
Tank Communication

Non-Volatile Random Access Memory (NVRAM):
24 K

Read Only Memory (ROM):
32 K

Serial Port Baud Rates:
300, 1200, 2400 and 9600

Protocol:
Asynchronous Serial ASCII

Field Device I/O and Power Support:
Varec 4-Wire Transmitters
Matrix
IFU I/O

Power Supply:
110 or 220 VAC, 50/60 Hz

Power Consumption:
200 Watts maximum

Power Output:
48 Volts DC to Varec Transmitters at 3 Amps

Service Conditions

Operating Temperature Range:
0 ºC to +70 ºC (+32 ºF to +158 ºF)

Operating Humidity Range:
5% to 95% Relative Humidity Non-Condensing

Dimensions and Weights

NEMA 12 General Purpose Wall Mount Enclosure:

Height	- 20 inches (508 mm)
Width	- 16 inches (406 mm)
Depth	- 8.2 inches (210 mm)

Net Weight:
38 lb. (17.3 kg)

Shipping Weight:
55 lb. (25 kg)

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APPENDIX A - SOFTWARE CONFIGURATION

Configuring the System

The TSU is used with a daughter module. The available modules are 4-wire, matrix and IFU. The 4-wire and matrix daughter modules connect to a field termination board. This board contains the necessary terminal blocks to support the field wiring. A different termination board is used for matrix and 4-wire. No termination board is used with the IFU.

The TSU data base associated with each module must be programmed with all transmitter information to allow for proper communication with the host computer.

It is recommended that the tank ID number be the same as the physically strapped transmitter ID number entered in the TankView or System IV Software Tank Detail Display.

The **EX** command *must* be used upon completion of programming the Gateway board. If the **EX** command is not used to exit from the programming mode, the gauging port will remain inactive and result in tank communication errors.

Loading the Computer Diagnostic Software

Entering the TSU Configure Mode

From the main DIAG menu, type a **d** to select terminal mode. This mode allows interactive communication with the TSU from the computer keyboard. The default communications parameters are COMM PORT 1, BAUD RATE - 1200, DATA BITS - 7, PARITY - ODD and STOP BITS - 1. These can be changed by using the <F2-SETUP> key.

The computer is now essentially a "dumb" terminal and any data appearing at the lower left corner of the screen is from the TSU.

Type **#T** followed by the <**Enter**> key. The screen should scroll and display the current EPROM revision and a help prompt. Press the <**F1**> key and type **ID** followed by the <**Enter**> key to initialize the data base by clearing the Non-Volatile Random Access Memory (NVRAM) of all data. The tank configuration table in the TSU is now clear and ready to be configured.

Programming the 4-Wire Module

Before beginning this procedure, ensure that the Gateway Micro 4-Wire module is installed. Jumpers JP12-14 should be set as follows for the Micro 4-Wire module:

JP12	JP13	JP14
Off	On	Off

1. Type **AT** <**Enter**>. This is the Add Tank command. The screen displays:

```
THERE ARE CURRENTLY NNN TANKS IN THE DATA BASE
THERE IS ROOM FOR NNN MORE TANKS IN THE DATA BASE
TANK ID.  (001-999)?
```

   Where: NNN = number of tanks

2. Type the tank ID number followed by <**Enter**>. The screen displays:

```
TRANSMITTER TYPE
        (3 = 1800)
        (4 = 1900)
TYPE?
```

Note that the Model 6603 Tankside Receiver responds as a 1800 transmitter at low speed.

3. Type **3** or **4** <**Enter**>. The screen displays:

```
TRANSMITTER ID (001-999)?
```

4. Type the transmitter ID number followed by <**Enter**>. The screen displays:

```
LEVEL UNITS TYPE
                    (1 = FRACTIONAL ENGLISH)
                    (2 = DECIMAL ENGLISH)
                    (3 = 0-20 METERS)
                    (4 = 0-30 METERS)
TYPE?
```

5. Type the selection followed by <**Enter**>. The screen displays:

```
DOES THIS TANK HAVE TEMPERATURE (Y OR N)?
```

6. Type the selection. With a **Y** <**Enter**> response, the screen displays:

```
TEMPERATURE SCALE (C OR F)?
```

7. Type either **C** or **F** <**Enter**>. The screen displays:

```
AREA (0-3)?
```

8. There are four separately fused areas on the Micro 4-Wire module. Type the area number followed by <**Enter**>. The screen displays:

```
TRANSMITTER SPEED, HIGH OR LOW (H OR L)?
```

9. Type **H** or **L** <**Enter**>. The screen displays the tank table for this tank and prompts:

```
IS THIS ENTRY CORRECT (Y OR N)?
```

10. If **N** <**Enter**> is typed, corrections to the entry can be made.

11. When correct, type **Y** <**Enter**>. The screen displays:

```
----- WAIT WHILE I UPDATE THE DATA BASE CRC -----
```

12. Wait approximately six seconds for the data base CRC to be updated. The screen displays:

```
YOU HAVE ADDED XXX TANKS TO THE DATA BASE
DO YOU WANT TO ADD ANOTHER TANK (Y OR N)?
```

Continue programming all of the tank transmitters into the Non-Volatile Random Access Memory (NV RAM) of the Gateway board. This NVRAM is battery backed so that the information entered is not lost, even if power to the Gateway board is turned off.

After all the tanks are programmed, type **EX** <**Enter**> to put the Gateway board in the on-line mode.

Programming the IFU Module

There are several different types of connections possible for the TSU with IFU interface. Please consult the factory for use with Remote Selector or Tone Link.

Before beginning this procedure, ensure that the Gateway IFU module is installed. Jumpers JP12-14 should be set as follows for the IFU module:

JP12	**JP13**	**JP14**
On	Off	Off

There are five possible access types for this module:

- Locally Wired Matrix
- Remote Selector
- Remote Selector with Tone Link
- 4-Wire Bus
- 4-Wire Bus with Tone Link

Locally Wired Matrix

1. Type **AT** <**Enter**>. This is the Add Tank command. The screen displays:

```
THERE ARE CURRENTLY NNN TANKS IN THE DATA BASE
THERE IS ROOM FOR NNN MORE TANKS IN THE DATA BASE
TANK ID. (001-999)?
```

   Where: NNN = number of tanks

2. Type the tank ID number followed by <**Enter**>. The screen displays:

```
ACCESS TYPE
        (1 = LOCALLY WIRED MATRIX)
        (2 = REMOTE SELECTOR)
        (3 = REMOTE SELECTOR WITH TONE LINK)
        (4 = 4-WIRE BUSS)
        (5 = 4-WIRE BUSS WITH TONE LINK)
TYPE?
```

3. Type **1** <**Enter**> The screen displays:

```
TRANSMITTER TYPE
        (1 = 1600)
        (2 = 1700)
        (5 = 2400)
TYPE?
```

4. With a **1** <**Enter**> response, the screen displays:

```
LEVEL UNITS TYPE
                (1 = FRACTIONAL ENGLISH)
                (2 = DECIMAL ENGLISH)
TYPE?
```

5. With a **2** <**Enter**> response for transmitter type, the screen displays:

```
LEVEL UNITS TYPE
                (3 = 0-20 METERS)
                (4 = 0-30 METERS)
TYPE?
```

6. Type the selection followed by <**Enter**>. The screen displays:

```
B+ CODE (0-9)?
```

7. Select the B+ code followed by <**Enter**>. The screen displays:

```
B- CODE (0-9)?
```

8. Select the B- code followed by <**Enter**>. The screen displays:

```
B+ GROUP OR MULTIPLIER (0-7)?
```

   This refers to the GROUP (B+ board) used in the IFU. There can be up to 100 transmitters wired per group.

9. Select the B+ GROUP or MULTIPLIER followed by <**Enter**>. The screen displays:

```
KS CODE (0-8)?
```

   This refers to the A to D temperature converter used with the IFU only if temperature is selected. One KS line is used for each A to D converter.

10. Select the KS CODE followed by <**Enter**>. The screen displays:

```
TRANSMITTER SPEED, HIGH OR LOW (H OR L)?
```

11. Type **H** or **L** followed by <**Enter**>. The screen displays the tank table for this tank and prompts:

```
IS THIS ENTRY CORRECT (Y OR N)?
```

12. If **N** <**Enter**> is typed, corrections to the entry can be made.

13. When correct, type **Y** <**Enter**>. The screen displays:

```
----- WAIT WHILE I UPDATE THE DATA BASE CRC -----
```

14. Wait approximately six seconds for the data base CRC to be updated. The screen displays:

```
YOU HAVE ADDED XXX TANKS TO THE DATA BASE
DO YOU WANT TO ADD ANOTHER TANK (Y OR N)?
```

Continue programming all of the tank transmitters into the Non-Volatile Random Access Memory (NVRAM) of the Gateway board. This NVRAM is battery backed so that the information entered is not lost, even if power to the Gateway board is turned off.

After all the tanks are programmed, type **EX** <**Enter**> to put the Gateway board in the on-line mode.

4-Wire Bus

1. Type **AT** <**Enter**>. This is the Add Tank command. The screen displays:

```
THERE ARE CURRENTLY NNN TANKS IN THE DATA BASE
THERE IS ROOM FOR NNN MORE TANKS IN THE DATA BASE
TANK ID. (001-999)?
```

Where: NNN = number of tanks

2. Type the ID number of the tank to be programmed. The screen displays:

```
ACCESS TYPE
        (1 = LOCALLY WIRED MATRIX)
        (2 = REMOTE SELECTOR)
        (3 = REMOTE SELECTOR WITH TONE LINK)
        (4 = 4-WIRE BUSS)
        (5 = 4-WIRE BUSS WITH TONE LINK)
TYPE?
```

3. Type **4** or **5** followed by <**Enter**>. The screen displays:

```
TRANSMITTER TYPE
        (3 = 1800)
        (4 = 1900)
```

4. With an entry of **3** or **4** followed by <**Enter**>, the screen displays:

```
TRANSMITTER ID (001-999)?
```

5. Type the transmitter ID. followed by <**Enter**>. The screen displays:

```
LEVEL UNITS TYPE
                (1 = FRACTIONAL ENGLISH)
                (2 = DECIMAL ENGLISH)
                (3 = 0-20 METERS)
                (4 = 0-30 METERS)
TYPE?
```

6. Type the selection followed by <**Enter**>. The screen displays:

```
DOES THIS TANK HAVE TEMPERATURE (Y OR N)?
```

7. With a **Y** response, the screen displays:

```
TEMPERATURE SCALE (C OR F)?
```

8. Type either **C** or **F** followed by <**Enter**>. After typing an answer, the screen displays:

```
AREA (0-7)?
```

9. Type an area number and <**Enter**>. The screen displays:

```
TRANSMITTER SPEED, HIGH OR LOW (H OR L)?
```

10. Type **H** or **L** followed by <**Enter**>. The screen displays the tank table for this tank and prompts:

```
IS THIS ENTRY CORRECT (Y OR N)?
```

11. If **N** <**Enter**> is typed, corrections to the entry can be made.

12. If **Y** <**Enter**> is typed, the screen displays:

```
----- WAIT WHILE I UPDATE THE DATA BASE CRC -----
```

13. Wait approximately six seconds for the data base CRC to be updated. The screen displays:

```
YOU HAVE ADDED XXX TANKS TO THE DATA BASE
DO YOU WANT TO ADD ANOTHER TANK (Y OR N)?
```

Continue programming all of the tank transmitters into the Non-Volatile Random Access Memory (NVRAM) of the Gateway board. This NVRAM is battery backed so that the information entered is not lost, even if power to the Gateway board is turned off.

After all the tanks are programmed, type **EX** <**Enter**> to put the Gateway board in the on-line mode.

Programming the Matrix Module

Before beginning this procedure, ensure that the Gateway matrix module is installed. Jumpers JP12-14 should be set as follows for the matrix module:

JP12	**JP13**	**JP14**
ON	ON	OFF

1. Type **AT** <**Enter**>. This is the Add Tank command. The screen displays:

```
THERE ARE CURRENTLY NNN TANKS IN THE DATA BASE
THERE IS ROOM FOR NNN MORE TANKS IN THE DATA BASE
TANK ID. (001-999)?
```

Where: NNN = number of tanks

2. Type the ID number of the tank to be programmed. The screen displays:

```
TRANSMITTER TYPE
        (1 = 1600)
        (2 = 1700)
        (5 = 2400)
```

3. With an entry of **1** <**Enter**>, the screen displays:

```
LEVEL UNITS TYPE
        (1 = FRACTIONAL ENGLISH)
        (2 = DECIMAL ENGLISH)
TYPE?
```

4. With an entry of **2** <**Enter**> for transmitter type, the screen displays:

```
LEVEL UNITS TYPE
        (3 = 0-20 METERS)
        (4 = 0-30 METERS)
TYPE?
```

5. Type the selection followed by <**Enter**>. The screen displays:

```
DOES THIS TANK HAVE TEMPERATURE (Y OR N)?
```

6. After typing an answer, the screen displays:

```
B+ CODE (0-9)?
```

7. Select the B+ code. The screen displays:

```
B- CODE (0-9)?
```

8. Select the B- code. The screen displays:

```
TRANSMITTER SPEED, HIGH OR LOW (H OR L)?
```

9. Type **H** or **L** followed by <**Enter**>. The screen displays the tank table for this tank and prompts:

```
IS THIS ENTRY CORRECT (Y OR N)?
```

10. If **N** <**Enter**> is typed, corrections to the entry can be made.

11. If **Y** <**Enter**> is typed, the screen displays:

```
----- WAIT WHILE I UPDATE THE DATA BASE CRC -----
```

12. Wait approximately six seconds for the data base CRC to be updated. The screen displays:

```
YOU HAVE ADDED XXX TANKS TO THE DATA BASE
DO YOU WANT TO ADD ANOTHER TANK (Y OR N)?
```

Continue programming all of the tank transmitters into the Non-Volatile Random Access Memory (NVRAM) of the Gateway board. This NVRAM is battery backed so that the information entered is not lost, even if power to the Gateway board is turned off.

After all the tanks are programmed, type **EX** <**Enter**> to put the Gateway board in the on-line mode.

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APPENDIX B - GATEWAY UTILITIES SOFTWARE

Introduction

The Gateway Utilities software allows the user of a Varec Series 6820 Tank Scanning Unit or Gateway board to store, modify and print out the Gateway database.

The Gateway Utilities software has not been tested by Whessoe Varec, Inc. under all possible operational conditions, and Whessoe Varec, Inc. does not have all the data relative to your application.

The information in this appendix is not all inclusive and does not and cannot take into account all unique situations. Consequently, you must take any risks for the use of this product.

System Configuration

The program is supplied on floppy disk for operation within an IBM PC or fully IBM-compatible computer. The Gateway Utilities software is designed to run from floppy disk, however, the program may be installed on the users hard disk.

In addition to a Varec Series 6820 Tank Scanning Unit, the following is the minimum hardware required to operate the Gateway Utilities software:

- IBM compatible computer with 640K of RAM or greater
- CGA or better graphics card and monitor
- DOS version 3.2 or greater
- RS-232C serial I/O port (set at address 3F8h)
- Parallel port for printer
- Floppy disk drive (3.5-inch or 5-1/4-inch)
- Cable to connect Gateway board and computer.

Installation

Note
If this program is installed on a hard disk, only one Gateway data base may be maintained.

Hard Disk Drive Installation

Make sure that your PC is running DOS version 3.3 or greater before loading the Gateway Utilities software.

1. Insert the Gateway Utilities disk in a floppy disk drive.
2. Copy all files to any directory on the hard disk.

After the files have been copied, the program is ready for operation on the hard disk. The following files are found on the Gateway Utilities floppy disk:

- GWUTIL.EXE
- 4WIREAS.EXE
- MATRIXAS.EXE

Floppy Disk Drive Installation

This is the recommended installation, allowing the user to place tank data on a separate disk and to maintain different data bases for multiple gateway systems

1. Make a backup copy of the master diskette using the DOS *diskcopy* command.
2. Format a blank tank data disk using the DOS *format* command.
3. Determine whether 4 wire or matrix tanks are to be used.
4. Copy the following files from the master disk to the tank data disks:
   - 4WIREAS.EXE (for 4-wire tanks)
   - MATRIXAS.EXE (for matrix tanks)

Setup

This procedure will take the user through a step by step installation of 4-wire and matrix tanks with duplicate data.

WARNING

If one of the following utilities is used, the tank data must be created on a separate disk or when the GWUTIL.EXE program is initially loaded, *all tank data will be erased.*

4-Wire Transmitters

1. Place the tank data disk with the program 4WIREAS.EXE in drive *A*.

2. Type **a:4wireas** and press <**Enter**>. When the program has loaded the screen displays the following:

```
THIS UTILITY WILL CREATE 4-WIRE TANKS WITH DUPLICATE DATA
WHICH AREA ( 0 - 3 ) ?
```

3. Type **0, 1, 2, or 3** followed by <**Enter**>. The screen displays:

```
STARTING TANK I.D. ?
```

4. Type **1 - 998** followed by <**Enter**>. The screen displays:

```
ENDING TANK I.D. ?
```

Note
Ending tank ID must exceed starting ID for a maximum of 100 tanks per area or 175 tanks total.

5. Type **2 - 999** followed by <**Enter**>. The screen displays:

```
TRANSMITTER TYPE
3 = 1800
4 = 1900
```

6. Type **3** or **4** followed by <**Enter**>. The screen displays:

```
LEVEL UNITS TYPE
 1 = FRACTIONAL ENGLISH
 2 = DECIMAL ENGLISH
 3 = 0 - 20 METERS
 4 = 0 - 30 METERS
```

7. Type **1 - 4** followed by <**Enter**>. The screen displays:

```
DO THESE TANKS HAVE TEMPERATURE  (Y/N) ?
```

8. Type **y** or **n** followed by <**Enter**>. With a **y** response, the screen displays:

```
TEMPERATURE UNITS (C OR F) ?
```

9. Type **y** or **n** followed by <**Enter**>. With a **y** response, the screen displays:

```
TEMPERATURE UNITS (C OR F) ?
```

10. Type **c** or **f** followed by <**Enter**>. The screen displays:

```
TRANSMITTER SPEED (H OR L) ?
```

11. Type **h** or **l** followed by <**Enter**>. The screen displays:

```
ARE THESE ENTRIES CORRECT (Y/N) ?
```

12. Type **y** or **n** followed by <**Enter**>. With a **n** response, the program will return to the initial prompt. With a **y** response, the program will start writing the tank data base and the screen displays:

```
WRITING DATA FOR TANK XXX
```

13. After all tank data has been written to disk, the program will prompt:

```
DO YOU WISH TO ADD ANOTHER AREA ?
```

14. Type **y** or **n** followed by <**Enter**>.

    With a **y** response, the program will return to the original prompt. With a **n** response, the program will terminate.

Note

If tank IDs are duplicated, the program will rewrite the files on disk to the new configuration. The tank ID and the transmitter ID will be the same.

WARNING

This program should only be run on initial establishment of duplicate data. Running this program on a disk with existing tank data will erase all the tank data and replace it with new data.

Matrix Transmitters

1. Place the tank data disk with the program MATRIXAS.EXE in drive *A*.

2. Type **a:matrixas** and press <**Enter**>. When the program has loaded the screen displays the following:

```
THIS UTILITY WILL CREATE MATRIX TANKS WITH DUPLICATE DATA
STARTING TANK ID ?
```

3. Type **1 - 198** followed by <**Enter**>. The screen displays:

```
ENDING TANK I.D. ?
```

Note
Ending tank ID must exceed starting tank ID.

4. Type 1 **- 199** followed by <**Enter**>. The screen displays:

```
TRANSMITTER TYPE
1 = 1600
2 = 1700
5 = 2400
```

5. Type **1, 2** or **5** followed by <**Enter**>. The screen displays:

```
LEVEL UNITS TYPE
 1 = FRACTIONAL ENGLISH
 2 = DECIMAL ENGLISH
 3 = 0 - 20 METERS
 4 = 0 - 30 METERS
```

Note
For Transmitter Type 1, only options 1 and 2 are displayed and valid.
For Transmitter Type 2, only options 3 and 4 are displayed and valid.
For Transmitter Type 5, no options are displayed and the screen displays the temperature message shown in step 6.

6. Type **1 - 4** followed by <**Enter**>. The screen displays:

```
DO THESE TANKS HAVE TEMPERATURE  (Y/N) ?
```

7. Type **y** or **n** followed by <**Enter**>. With a **y** response, the screen displays:

```
TEMPERATURE UNITS (C OR F) ?
```

8. Type **y** or **n** followed by <**Enter**>. With a **y** response, the screen displays:

```
TEMPERATURE UNITS (C OR F) ?
```

9. Type **c** or **f** followed by <**Enter**>. The screen displays:

```
TRANSMITTER SPEED (H OR L) ?
```

10. Type **h** or **l** followed by <**Enter**>. The screen displays:

```
ARE THESE ENTRIES CORRECT (Y/N) ?
```

11. Type **y** or **n** followed by <**Enter**>. With a **n** response, the program will return to the initial prompt. With a **y** response, the program will start writing the tank data base and the screen displays:

```
WRITING DATA FOR TANK XXX
```

12. After all tank data has been written to disk, the program will terminate and return to DOS.

Note

The B+ and B- values written to disk will correspond to the tank ID.

Examples: Tank ID = 100, then B+ = 0, B- = 0
Tank ID = 137, then B+ = 3, B- = 7

WARNING

This program should only be run on initial establishment of duplicate data. Running this program on a disk with existing tank data will erase all the tank data and replace it with new data.

GWUTIL.EXE Program

The above two programs, (4WIREAS.EXE & MATRIXAS.EXE) will create the following required files for the GWUTIL.EXE program to operate.

- TANKNUM - ASCII file containing the number of current active tanks on the current disk.
- XMTRTYPE - ASCII file containing the type of active tanks on the current disk. Either 4-wire or matrix.
- XMTRNAM - ASCII file containing the names of current active tanks on the current disk
- TANKXXX - Tank data record for tank XXX, containing all information associated with that tank necessary for download to a Gateway board. (where XXX = tank ID)

Installation and Operation

Place the backup disk of the master disk in drive A, type **gwutil** and press <**Enter**>.

The GWUTIL.EXE program will create the file GWCON.01 and the associated tank files necessary for proper operation of the program.

Main Menu Options

1. Change Port Configuration

Press the **1** key to access this option.

A sub-menu will appear on the bottom of the screen. Press the desired key to change the port configuration.

B = BAUD

Increments the baud rate if the Gateway port is set to I/O. (1200, 9600)

D = DATA BITS

Increments the data bits if the Gateway port is set to I/O. (7, 8)

P = PARITY

Increments the parity if the Gateway port is set to I/O. (O = odd, N = none, E = even

C = COM PORT

Increments the selected download IBM communications port. (COM1, COM2)

G = GW

Increments the selected gateway download port. (CONFIG, I/O)

> **Note**
> If CONFIG is selected for the Gateway port, the program defaults to 9600 baud, 8 data bits, no parity and 1 stop bit.

E = EXIT

Exits the port configuration and returns the program to the main menu.

2. Save Port Configuration

Press the **2** key to access this option.

The currently displayed configuration is saved to disk and will become the default value upon loading of the program.

3. Enter Tank Data to Disk

Press the **3** key to access this option.

Takes the user to the Tank Data Menu screen. This menu is used to enter new tank data, edit existing tank data, change data disks and initialize disks for tank data.

CHANGE XMTR TYPE

Accessed by pressing the **1** key. Toggles the XMTR TYPE field between 4WIRE, MATRIX, and IFU transmitters. If this key is pressed and the number of tanks on the disk is greater than zero, the message CANNOT CHANGE XMTR TYPE WITH TANKS ON DISK is displayed.

INITIALIZE DISK

Accessed by pressing the **2** key. Erases all tank files and rewrites them to the current configuration. A warning banner is displayed and requires a Y entry to perform the above step to prevent accidental erasure of tank data.

CHANGE DATA DISKS

Accessed by pressing the **3** key. Allows the user to place their tank data disk in the drive and return to the program. The system will prompt PLACE DATA DISK IN DRIVE AND PRESS ANY KEY. This is the recommended operation for this program.

ENTER TANK DATA

Accessed by pressing the **4** key. Allows the user to create a new tank data base on the disk currently in the drive. A warning will be displayed prompting the user for confirmation of disk initialization.

4-Wire Entry

The following is a list of prompts that the program will display:

TANK ID (001 - 999) ?

TRANSMITTER TYPE:
3 = 1800
4 = 1900
TYPE ?

TRANSMITTER ID (000 - 999) ?

LEVEL UNITS TYPE
1 = FRACTIONAL ENGLISH
2 = DECIMAL ENGLISH
3 = 0 - 20 METERS
4 = 0 - 30 METERS
TYPE ?

DOES THIS TANK HAVE TEMPERATURE (Y/N) ?

TEMPERATURE SCALE (C OR F) ?
This prompt is only displayed if this tank has temperature.

AREA (0 - 3) ?

TRANSMITTER SPEED, HIGH OR LOW (H OR L) ?

IS THIS ENTRY CORRECT (Y/N) ?

DO YOU WANT TO ADD ANOTHER TANK ? (Y/N) ?

Matrix Entry

The following is a list of prompts that the program will display:

TANK I.D. (001 - 999) ?

TRANSMITTER TYPE
1 = 1600
2 = 1700
5 = 2400
TYPE ?

LEVEL UNITS TYPE
IF XMTR TYPE = 1:
1 = FRACTIONAL ENGLISH
2 = DECIMAL ENGLISH
IF XMTR TYPE = 2
3 = 0 - 20 METERS
4 = 0 - 30 METERS
IF XMTR TYPE = 5, NO LEVEL UNITS WILL BE DISPLAYED.

DOES THIS TANK HAVE TEMPERATURE (Y/N) ?

B+ CODE (0 - 9) ?

B- CODE (0 - 9) ?

TRANSMITTER SPEED, HIGH OR LOW (H OR L) ?

IS THIS ENTRY CORRECT (Y/N) ?

DO YOU WANT TO ADD ANOTHER TANK ? (Y/N) ?

IFU Entry - Locally Wired Matrix Transmitters

The following is a list of prompts that the program will display:

TANK I.D. (001-999) ?
ACCESS TYPE
(1 = LOCALLY WIRED MATRIX)
(2 = REMOTE SELECTOR)
(3 = REMOTE SELECTOR WITH TONE LINK)
(4 = 4 WIRE BUS)
(5 = 4 WIRE BUS WITH TONE LINK)
TYPE ?

TRANSMITTER TYPE
(1 = 1600)
(2 = 1700)
(5 = 2400)
TYPE ?

LEVEL UNITS TYPE
IF XMTR TYPE = 1:
1 = FRACTIONAL ENGLISH
2 = DECIMAL ENGLISH
IF XMTR TYPE = 2
3 = 0 - 20 METERS
4 = 0 - 30 METERS
IF XMTR TYPE = 5, NO LEVEL UNITS WILL BE DISPLAYED.

DOES THIS TANK HAVE TEMPERATURE (Y/N) ?

B+ CODE (0 - 9) ?

B- CODE (0 - 9) ?

B+ GROUP OR MULTIPLIER (0-7) ?
This refers to the B+ group board used in the IFU.

KS CODE (0-8) ?
This is only displayed if the tank has temperature and refers to the A to D converter used with the IFU.

TRANSMITTER SPEED (H OR L) ?

IS THIS ENTRY CORRECT (Y/N) ?

IFU Entry - 4-Wire Bus

The following is a list of prompts that the program will display:

TANK I.D. (001-999) ?

ACCESS TYPE
(1 = LOCALLY WIRED MATRIX)
(2 = REMOTE SELECTOR)
(3 = REMOTE SELECTOR WITH TONE LINK)
(4 = 4 WIRE BUS)
(5 = 4 WIRE BUS WITH TONE LINK)
TYPE ?

TRANSMITTER TYPE
(3 = 1800)
(4 = 1900)
TYPE ?
TRANSMITTER I.D. (001 - 999) ?

LEVEL UNITS TYPE
IF XMTR TYPE = 1:
1 = FRACTIONAL ENGLISH
2 = DECIMAL ENGLISH
3 = 0 - 20 METERS
4 = 0 - 30 METERS
TYPE ?

DOES THIS TANK HAVE TEMPERATURE (Y/N) ?

TEMPERATURE SCALE (C OR F) ?

AREA (0-7) ?

TRANSMITTER SPEED (H OR L) ?

IS THIS ENTRY CORRECT (Y/N)?

DO YOU WANT TO ADD ANOTHER TANK (Y/N) ?

EDIT EXISTING TANK DATA

Accessed by pressing the **5** key. Allows the user to change existing tank data or add a tank to the existing data base.

To edit an existing tank, simply type the tank ID and press <**Return**>. The system will then display that tanks current data and prompt DO YOU WISH TO EDIT THIS TANK (Y/N) ?. Pressing **n** will return you to the tank data menu while pressing **y** will take you through the prompts described previously in *Enter Tank Data*.

To add a new tank, simply type the tank ID you wish to add and press <**Return**>. This will take you through the prompts described previously in *Enter Tank Data*.

RETURN TO MAIN MENU

Accessed by pressing the **6** key. This option will return the user to the main menu.

4. Print Tank Data Base Report

Press the **4** key to access this option.

The program will display PRINTING TANK DATA BASE REPORT and print the header on the printer depending upon the type of transmitters in the data base and print all tanks currently programmed in the data base.

5. Download All Tanks to Gateway

Press the **5** key to access this option.

The program will then establish Gateway communications , reset the data base and download all tanks on disk to the Gateway database.

Note
Only 11 attempts are made to establish communications. If the Gateway does not respond within 11 tries, an error message will be displayed and the program will return to the Main Menu screen.

6. Upload Tanks to Disk

Press the **6** key to access this option.

The program will then establish Gateway communications, reset the database, upload all tanks in the Gateway database and save the information on disk.

Note
Performing this step replaces all data on disk with the new data from the Gateway. The Gateway board does not send back type of transmitter when dealing with metric tanks; 0 - 20 Meters is therefore assumed. If 0 - 30 Meter tanks are present, use Option 5 from the Tank Data Menu to correct those tanks.

7. Add Tanks to Gateway Data Base

Press the **7** key to access this option.

The program will then establish gateway communications, check each ID programmed in the data base to the tank ID programmed in the Gateway. As an ID is found that does not exist, that tank is then programmed into the Gateway.

Note
This function will not replace data for an existing ID with new data from the data base, only program those tanks that did not previously exist.

8. Exit Utilities to DOS

Press the **8** key to access this option.

This option will return the user to the DOS prompt.

File Organization

GWCON.01

This file is the serial I/O port configuration of the program and contains the following information:

- COM port baud rate
- COM port data bits
- COM port parity
- Gateway interface port
- IBM serial I/O port

The GWCON.01 file is organized as follows:

```
BBBB,D,P
GGGGGG
IIII
```

where:

BBBB	=	baud rate (1200 or 9600)
D	=	data bits (7, 8)
P	=	parity (e = even, o = odd, n = none)
GGGGGG	=	Gateway interface port (CONFIG, I/O)
IIII	=	selected IBM serial port (COM1, COM2)

TANKNUM

This file contains the number of active tanks associated with the current disk. This information is stored in an ASCII numeric format, i.e. 11.

XMTRNAM

This file contains a list of the active tank data files on the current disk. Each file is separated by commas.

The XMTRNAM file is organized as follows:

111,222,333,444,etc.

where:

111	=	tank name of the first tank
222	=	tank name of the second tank
333	=	tank name of the third tank

The tank names must be separated by commas.

XMTRTYPE

This file contains the type of transmitters on the current disk; either 4-wire or matrix.

Tank Data File Formats

The file TANKXXX, where XXX = the tank name in the XMTRNAM file, contains all the information required to establish that tank in the Gateway's data base.

4-Wire Tanks

This file is organized as follows:

TTTLXXXUMSAD

where:

TTT	=	tank name
L	=	transmitter type
XXX	=	transmitter i.d.
U	=	level units type
M	=	temperature
S	=	temperature scale
A	=	area
D	=	transmitter speed

Matrix Tanks

This file is organized as follows:

TTTLUMBCD

where:

TTT	=	tank name
L	=	transmitter type
U	=	level units type
M	=	temperature
B	=	b+ code
C	=	b- code
D	=	transmitter speed

Technical Notes

The GWUTIL.EXE program is a smart program capable of determining the type of processor in the IBM PC or compatible, and adjusting all communication timing loops accordingly. This program may be run on any type of computer as long as it meets the system requirements specified in the *System Configuration* section at the beginning of this appendix.

The major feature of this program is allowing the user to setup all tank data on a separate disk and copy that disk for their records. Using this program on a hard disk will prevent this feature from operating.

Due to the limited Gateway tank data base, this program has been limited to a maximum of 175 tanks per data base disk.

Program Operation Notes

On machines running at 4.77 MHz, problems may be encountered at 9600 baud. To correct this if problems are encountered, slow the baud rate down to 1200 baud.

If tank data is accidentally erased on a disk, the files XMTRNAM and TANKNUM may be rebuilt by hand.

INDEX

4-wire
  servo gauges, 7
  transmitters, 7
4-wire bus
  programming, 50
4-wire module
  programming, 46
Assembly
  power panel, 15
Communications
  Gateway board, 37
  serial, 7, 13
  TSU to host, 29
  TSU to modem, 14
Computer
  host, 1, 13, 29
Configuring a tank, 17
Daughter board module, 7
DIAG 2000, 5
Diagnostic software, 15
Dimensions, 43
Equipment
  optional, 6
  standard, 6
error codes, 30
Field transmitters
  non-Varec, 1
  power, 1
Field wiring
  4-wire transmitter, 23
  matrix transmitter, 24
Gateway board jumpers, 6
Gateway Utilities
  floppy drive installation, 56
  hard drive installation, 56
  program operation notes, 70
  software, 55
  technical notes, 70
Host computer, 1, 13, 29
IFU module
  programming, 48
Installation
  4-wire transmitter, 23
  matrix transmitter, 24
  mechanical, 17
  system, 26
Jumpers
  Gateway board, 6
LED array, 37
Locally wired matrix
  programming, 48
Matrix module
  programming, 52
Matrix transmitter
  gauging system, 12
  wiring, 12
message format, 29
MFT, 7
Modem, 14
Multifunction Transmitter (MFT), 7
Operating range
  ambient temperature, 18
Operation
  humidity range, 42
  temperature range, 42
Power, 42
Power panel assembly, 15
Programming
  4-wire bus, 50
  4-wire module, 46
  IFU module, 48
  locally wired matrix, 48
  matrix module, 52
Reset button, 37
RS232 I/O port, 37
Serial communications, 7
Spare parts, 41
Specifications, 42
System
  configuration, 45
Tank
  configuring, 17
  gauging, 17
termination board, 25
Test bench system, 15
Transmitters
  4-wire, 7
TSU
  cable to host computer, 13
  configure mode, 15, 45
  connections, 14
  data responses, 31
  electrical installation, 18
  error codes, 30
  grounding, 19
  maintenance, 35
  model options, 2
  mounting, 18
  startup procedure, 36
  troubleshooting, 35
  wire and cable installation, 18
Units
  English decimal, 31
  English fractional, 31
  Metric, 31
UPS, 18
Varec Model 4100 MFT, 7
Weight, 43

Wiring considerations
4-wire transmitter, 23
IFU, 25
matrix transmitter, 24
termination board, 25