INSTRUCTION MANUAL

for the

Varec Model 6850

Field Interface Converter (FIC)

Revisions

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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 Model 6850 Field Interface Converter. Follow all precautions and warnings noted herein when installing, operating or performing maintenance on this equipment.

Read and understand static and lightning electrical protection and grounding described in API 2003. Make certain that the tank installation, operation, and maintenance conforms with the practice set forth herein.

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SECTION 1 - INTRODUCTION

Use of this Manual

This manual is designed to assist you with the installation and operation of the Varec® Model 6850 Field Interface Converter (FIC). Proper operation of the converter requires care during the installation process. Long term, satisfactory performance may thus be obtained. If the installation quality is compromised, accuracy and life of the equipment may be degraded.

This Instruction Manual is organized as follows:

- Section 1   Introduction
- Section 2   Installation
- Section 3   Operation
- Section 4   Maintenance and Spare Parts
- Section 5   Specifications

Getting Acquainted with the Varec Field Interface Converter

The Varec Model 6850 Field Interface Converter (FIC) provides an interface between a RS-232 host and field devices which communicate over the EIA-485 or the Whessoe current loop interfaces. The FIC converts electrical signals and does not affect communication protocols. The most likely application would be interconnecting Varec Model 4100 Multifunction Transmitters, Whessoe Varec Intelligent Tank Gauges and a Varec TankView® Workstation.

The innovative design of the Model 6850 provides the flexibility to use the FIC for many other applications. For instance, it can be used with a modem to provide communications over long distances. It can also be used as an EIA-485 repeater to extend the distance of EIA-485 communications.

The Model 6850 is an industrial unit designed for operation in hostile environments. Components selected, including the power supply, are designed to operate at temperatures from -40 ºC to
+85 ºC. The NEMA Type 4 rated enclosure is suitable for installation outdoors in a non-hazardous area.

For safety reasons, field wiring should be isolated from any equipment with which an operator may be in contact. The possibility of high voltage transients or current surges induced by a nearby lightning strike is very real and could threaten the safety of the operator. The Varec Model 6850 Field Interface Converter uses optical couplers to ensure isolation.

For installations where the Model 6850 will be used with the Model 4100 Multifunction Transmitter, an optional 48 VDC, 3 Amp power supply is available. It can power up to 62 MFTs, distributed over two areas. The power supply connects to the AC primary and operates on 110 or 220 VAC.

Figure 1 shows the Model 6580 FIC without power supply. Figure 2 shows the Model 6850 FIC with power supply.

Features and Benefits

| Feature	Benefit
Facilitates interconnection of Varec EIA-485, RS-232 and Whessoe current loop devices	Provides interface for physical communication layer between field and host
Provides communication link between Varec Multifunction Transmitters (MFT) or Whessoe Intelligent Tank Gauges (ITG) and TankView	Ensures a reliable interface, with optical isolation, between field transmitters and control room host
Optically isolates field communication wiring from control room	Reduces risk of damage to equipment and operators due to line surges and high energy transients
Optional 3 Amp power supply provides 48 VDC for up to 62 Model 4100 Varec MFTs	3 Amp 48 Volt DC supply provides power to Varec MFTs with HART$^{®}$ Encoders
Status LEDs for line communication activity monitoring	Offers instant indication of communications activity on data lines to minimize troubleshooting and maintenance efforts
NEMA Type 4 wall mount enclosure	Suitable for mounting outdoors in non-hazardous areas
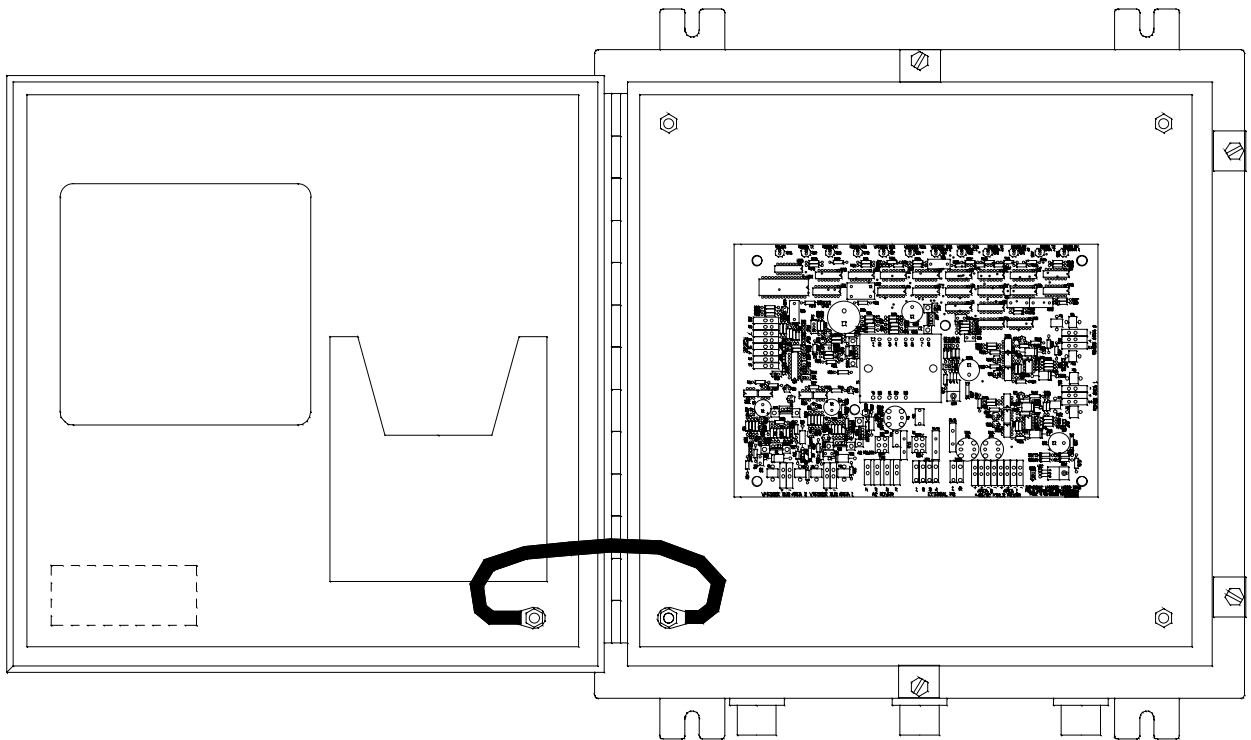
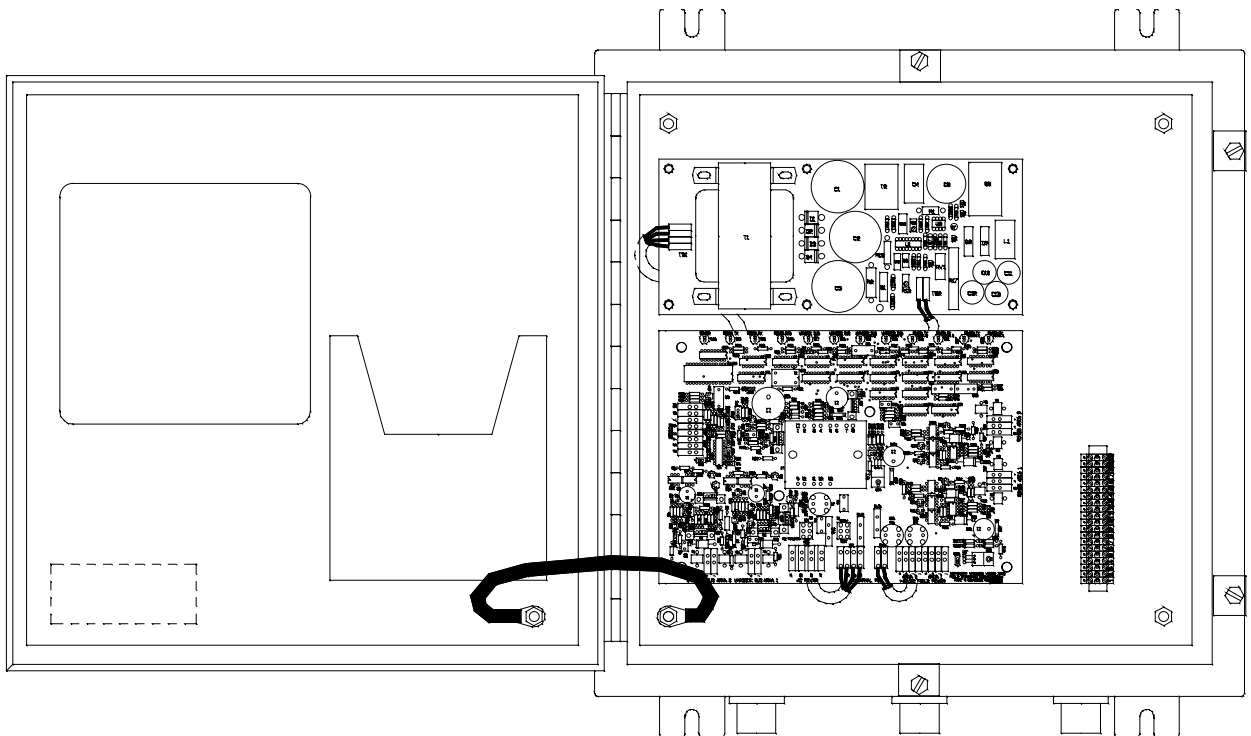Figure 1 Varec 6850 Field Interface Converter

Figure 2 Varec 6850 Field Interface Converter with Power Supply

SECTION 2 - INSTALLATION

Unpacking

Place the shipping container on a secure bench before unpacking. Open the shipping container, taking care not to damage the contents. Carefully remove the converter from the shipping container and place it on top of the bench. Inspect it for shipping damage. Report any damage to the carrier.

Varec Model 6850 Field Interface Converters are shipped fully assembled and ready for installation.

Storage Prior to Installation

If the converter is to be stored prior to installation, it should be repacked in its shipping container and stored in a temperature and humidity controlled environment.

Wall Mounting

The FIC is designed to mount on the wall. Figure 3 shows the outline dimensions of the unit. Use care when lifting the FIC and installing.

AC Power Input Configuration

The Varec Model 6850 Field Interface Converter (FIC) has two slide switches mounted near the center of the board. The left slide switch is the AC power switch and the right switch, which is partially shrouded, selects the AC input voltage. The default settings of these switches from the factory are AC power = OFF and AC input voltage = 110 V.

In addition, the default main power fuse installed in F1 is a 3 Amp type which is correct only for 110 V operation. If the FIC is to be powered from a 220 V source, this fuse should be replaced with the 1.5 Amp type which is taped to the top of the power transformer and the AC input voltage selection switch must be changed to the 220 V position.

WARNING

Be sure the 110/220 VAC voltage selector switch, S1, is properly set before applying power or damage to the unit will result.

Do not operate the 110/220 VAC selector switch, S1, when power is applied or damage to the unit will result.

AC Power Connection

A terminal is supplied for the connection of AC power to the FIC circuit board. At the bottom of the board is found a 4-connector terminal labeled AC POWER. Each connector is identified including H for hot (black wire), two terminals for ground (green wire), and the last connector, N, for neutral connection of the white wire.

Power Supply Connection

The optional power supply is factory installed and connects to the FIC board by a cable. The cable connects to the FIC circuit board at two terminals labeled EXTERNAL PS. These connections should not be disturbed by the customer. The power supply primary voltage is controlled by the FIC board AC power switch and voltage selection switch. No changes are required on the power supply or cabling for user's with 110- or 220 VAC input. The table below shows the connection of the cable between the FIC board and the power supply board.

Power Supply Terminals	Wire Color	FIC Board Terminals
TB1-1	Brown	JP1-1
TB1-2	Red	JP1-2
TB1-3	Orange	JP1-3
TB1-4	Yellow	JP1-4
TB2-1	Red	JP2+
TB2-2	Black	JP2-

Figure 3 Dimensional Outline of the Model 6850
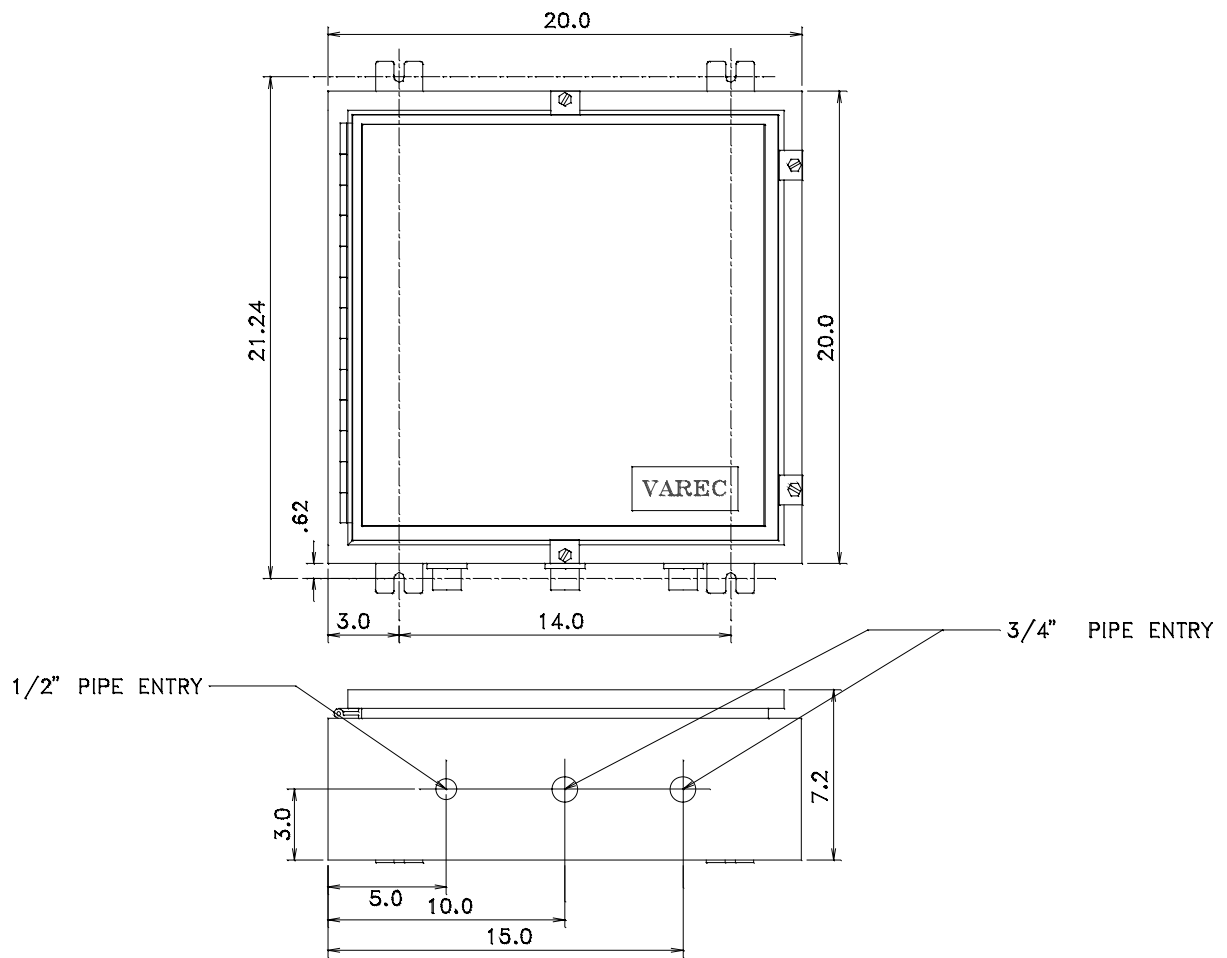
Earth Ground Connections

The FIC provides a very high level of isolation between the different ports as well as full lightning protection. This can only be effective if the earth ground connection to the FIC is nearby and of high integrity. Two earth ground terminal blocks are provided on the FIC, one for the AC power input ground wire and another for local earthing. The connection to the local earth ground wire should be made with 14 gauge wire.

Consult relevant electrical codes for proper earthing techniques.

Signal Connections

Computer Cable

The RS-232 computer cable supplied with the FIC is 25 feet long and has a DB25S connector at one end. The other end is a number of wires. The following chart shows the connection on the FIC circuit board. The terminals for connection are located to the right and are labeled RS-232. The cable supplied might have more wires than shown. If so, the extra wires are not required. Note that some cables have tan and brown wires. As these colors are difficult to distinguish, be sure and test the cable with an ohmmeter if in doubt.

Color	Terminal Pin
Tan	2
Red	3
Orange	4
Yellow	5
Green	6
Blue	7
Violet	8
Pink	20

DC Power Connection

Along the bottom of the FIC circuit board is found a terminal labeled +48VDC FIELD POWER. Four terminals are labeled (+) and four are labeled (-). The (+) is +48 VDC and the (-) is the power supply common. The power supply is only required in MFT applications. The labels AREA 0 and AREA 1 are suggested for use so that the customer may segregate the field wiring DC power along with the signal wiring.

Field Wiring Connection

The FIC supports EIA-485 or Whessoe Bus for connection to the field. The FIC does not support EIA-485 and Whessoe Bus at the same time. Do not connect both types of field wiring to the same FIC. The model with DC power supply offers a 20 connection terminal strip. The terminals are mounted on the right side of the FIC board. Whessoe Varec suggests the customer use these terminals to simplify field connections.

EIA-485

The EIA-485 connection is designed to communicate with the Varec Multifunction Transmitter, another FIC or some other EIA-485 type device. Two areas of EIA-485 communications are supported. The areas are isolated from each other electrically but the data transmitted is identical. Any devices connected to the areas must have unique addresses.

The terminal blocks for field connection for EIA-485 are located to the right of the FIC board. They are labeled EIA-485 AREA 1 and EIA-485 AREA 0. Each as three connections: C, (+) and (-). The C is a common and connects to the shield on the cable. The (+) and (-) are signals for connection to the field device. All EIA-485 (+) terminals are wired in parallel together. The same is true for the (-) connections.

When using the FIC with the Varec Multifunction Transmitter connect the EIA-485 (+) to the MFT MARK/485 (+) terminal. Connect the EIA-485 (-) to the MFT MARK/485 (-) terminal. All the transmitters are wired in parallel with (+) to (+) and (-) to (-).

Whessoe Bus

The Whessoe Bus terminal blocks are located at the lower left of the FIC board. They are labeled WHESSOE BUS AREA 0 and WHESSOE BUS AREA 1. These areas are electrically isolated and each area is addressed by use of the RS-232 DTR line. This is necessary because the Whessoe Intelligent Tank Gauge only supports device addresses in the range 0-31. Each area must have unique device addressing. The Varec TankView software is designed to support the two Whessoe Bus areas by using the DTR line. Only area 0 can be supported if a modem or line driver is attached to the RS-232 terminals.

All Whessoe Bus devices are attached in series. Each device has a LOOP (+) and LOOP (-) connection. Connect the FIC (+) to LOOP (+) on the first device. The second, and subsequent devices, connect (+) to (-). The last device LOOP (-) connects to the FIC (-).

The ITG has two data loop connections LOOP 1 and LOOP 2 for redundant field wiring. When wiring the ITG don't mix LOOP 1 and LOOP 2 connections. Do not connect LOOP 1 to FIC area 0 and LOOP 2 to FIC area 1. A second FIC must be used to install a redundant wiring scheme.

Function Jumper Descriptions

Each jumper consists of a three-pin male connector mounted on the FIC board and a movable shorting plug. On one end of each jumper connector there is a white block on the surface of the circuit board. The pin nearest to the white block is pin 1. Pin 2 is in the center and so on. Figure 5 shows the FIC circuit board and all jumpers.

The following describes the Field Interface Converter function jumpers and their appropriate settings:

EIA-485 Common	Area 0	Area 1	
Floating	1-2	1-2	
Connect to Earth Ground	2-3	2-3	
EIA-485 Termination	**Area 0**	**Area 1**	
200 Ohm	1-2	1-2	
100 Ohm	2-3	2-3	
External or none	Remove	Remove	
Transmit Enable Control	**JP7**	**JP14**	
RTS Control	1-2	2-3	
Automatic	2-3	1-2	
RS-232 Port Type	**JP11A**	**JP11B**	**JP11C**
DCE	2-3	1-2	1-2
DTE	1-2	2-3	2-3
RS-232 Mode	**JP12**		
Point to Point	1-2		
Multi-Drop	2-3		
Multi-Drop Termination	**JP13**		
Enabled	1-2		
Disabled	2-3		

Figure 4 Jumper Pin Association With Function

Jumpers JP3 and JP4

These jumpers provide an option to connect the common line of the Area 1 and Area 0 EIA-485 ports respectively to 48 V common and earth ground or not. For any EIA-485 communication bus, the common line must be tied to earth ground at one point.

When the FIC is used as an interface to Model 4100 MFTs, this connection must be made at the FIC using JP3 and JP4. When the FIC is used as a EIA-485 repeater, the common line for only one of the EIA-485 ports on each link must be tied to common.

Jumpers JP5 and JP6

These jumpers provide the option of selecting a 100 Ohm, 200 Ohm or external resistor for proper line termination of Area 1 and Area 0 EIA-485 ports respectively. The function of this resistor is to provide a resistive load to match the impedance characteristic of the field wiring used. Proper selection of the termination resistor preserves the accuracy of the communication pulses and improves the systems noise resistance.

While most systems will work properly without the use of line terminating resistors, selecting and using them will in general allow more reliable communication over longer distances and at higher baud rates. An exact match of the field wiring is not necessary and the 100 and 200 Ohm values should suffice for most systems. If a value other than 100 or 200 Ohms is desired, JP4 or JP5 can be removed and a resistor with the desired value can be connected directly to the (+) and (-) terminals of the EIA-485 ports.

Two line termination resistors should be used for each EIA-485 communication bus: one located at the FIC, (i.e. JP4, JP5) and one located at the far end of the bus. The exact location of the far end termination resistor can be somewhat tricky however due to the physical location of the remote EIA-485 devices and the extent of the branching that might be present. In general, the ideal location of the remote terminating resistor is the furthest away from the host while being the most centrally located relative to the remote EIA-485 devices.

Jumpers JP7 and JP14

These jumpers provide the option of allowing the host computer to control the EIA-485 tri-state driver enable via the RS-232 port RTS handshaking line (pin 4) or to automatically generate the driver enable in the FIC board itself. Using the handshaking mode provides the fastest access to the bus while the automatic mode adds 70 milliseconds of delay to each remote devices response time.

When the FIC is connected remotely to the host via a modem, or it is used as an interface to Whessoe type gauging equipment, the automatic mode must be selected.

Jumpers JP8, JP9 and JP10

These jumpers are for future use and should not be changed from the factory default settings.

Jumpers JP11A, JP11B and JP11C

These jumpers configure the RS-232 port as either a DCE or DTE type interface and provide the proper handshaking for each. The DCE type interface is used when the FIC is connected to a host computer directly while DTE mode is used when the FIC is connected to a modem.

Jumpers JP12 and JP13

It is possible for up to four FICs to share one RS-232 serial port at a time and the selection of these jumpers facilitate this. For this mode of operation, JP12 is set in the 2-3 position on all of the FICs and JP13 is set to position 1-2 on only one of the FICs and position 2-3 on all of the other FICs. In this mode, the wire length between the host computer and the FICs should be kept to less than 50 feet.
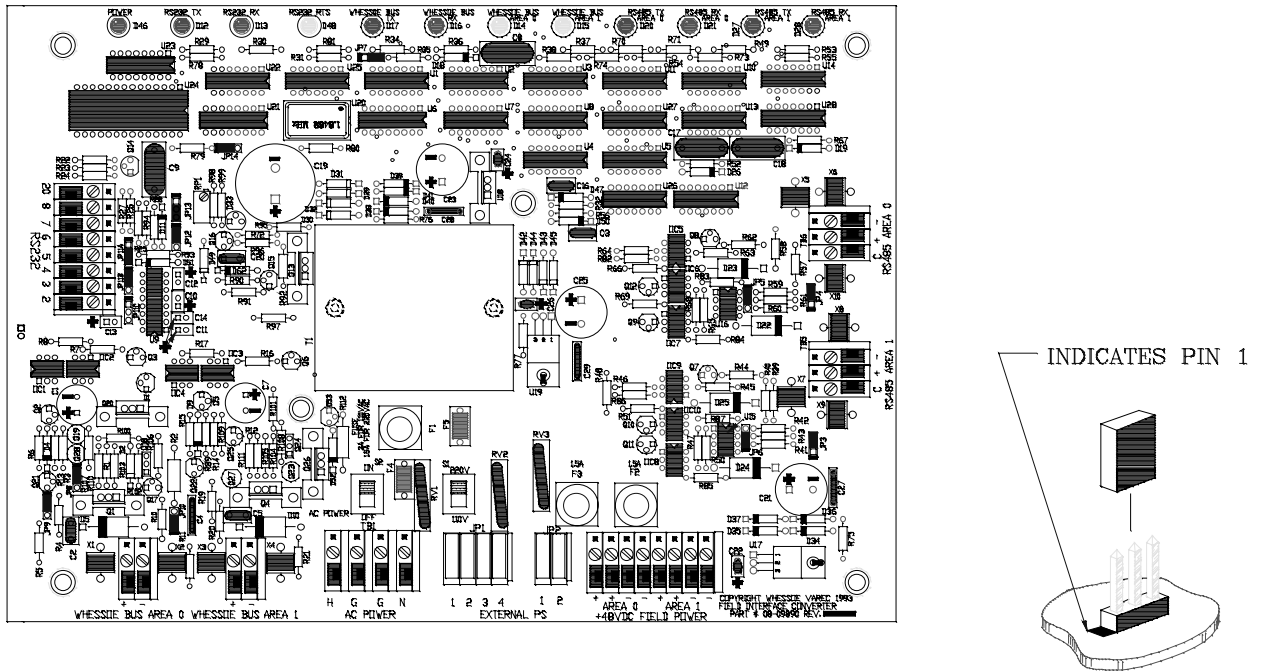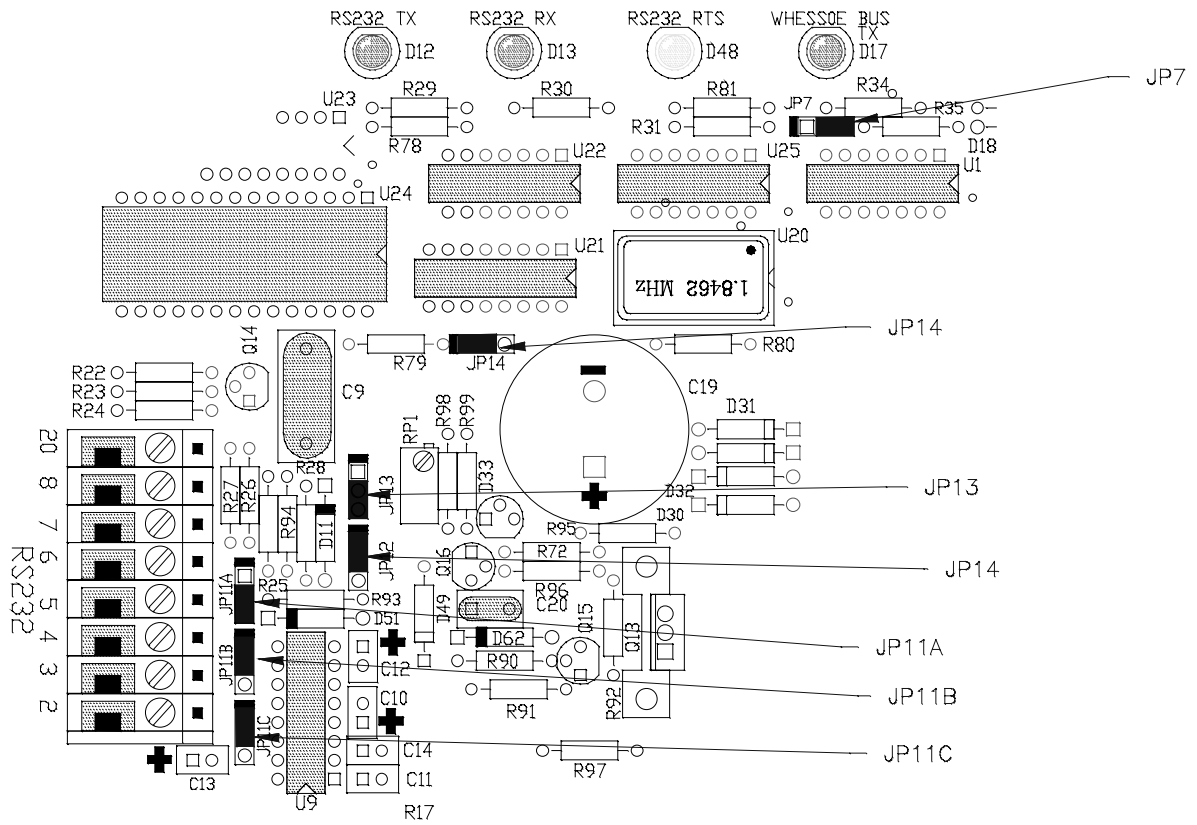

Figure 5 FIC Circuit Board

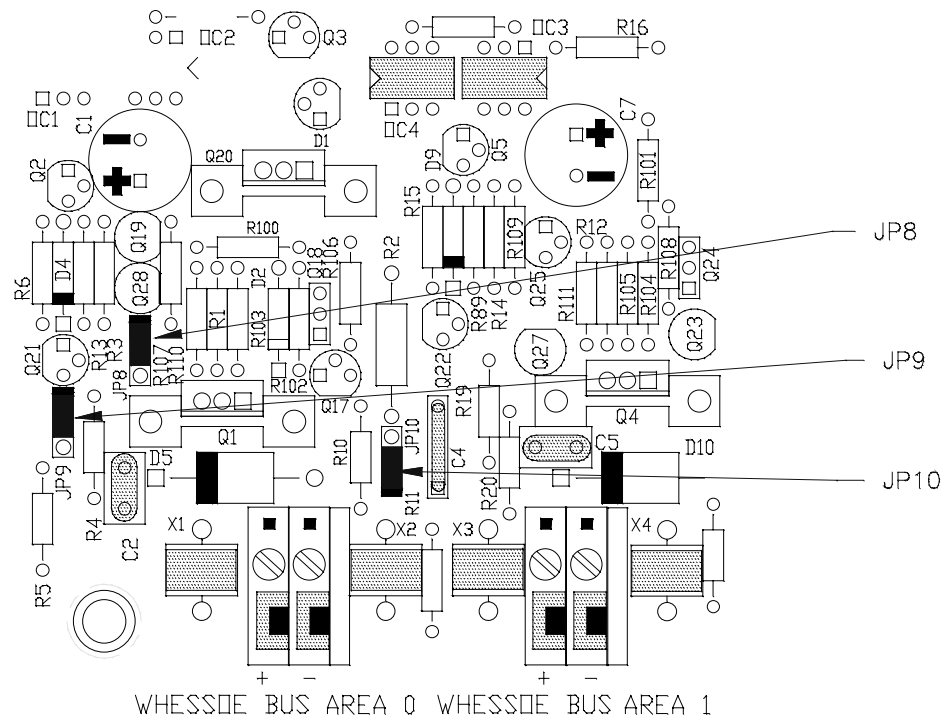Figure 6 FIC Circuit Board Showing Jumpers On Left
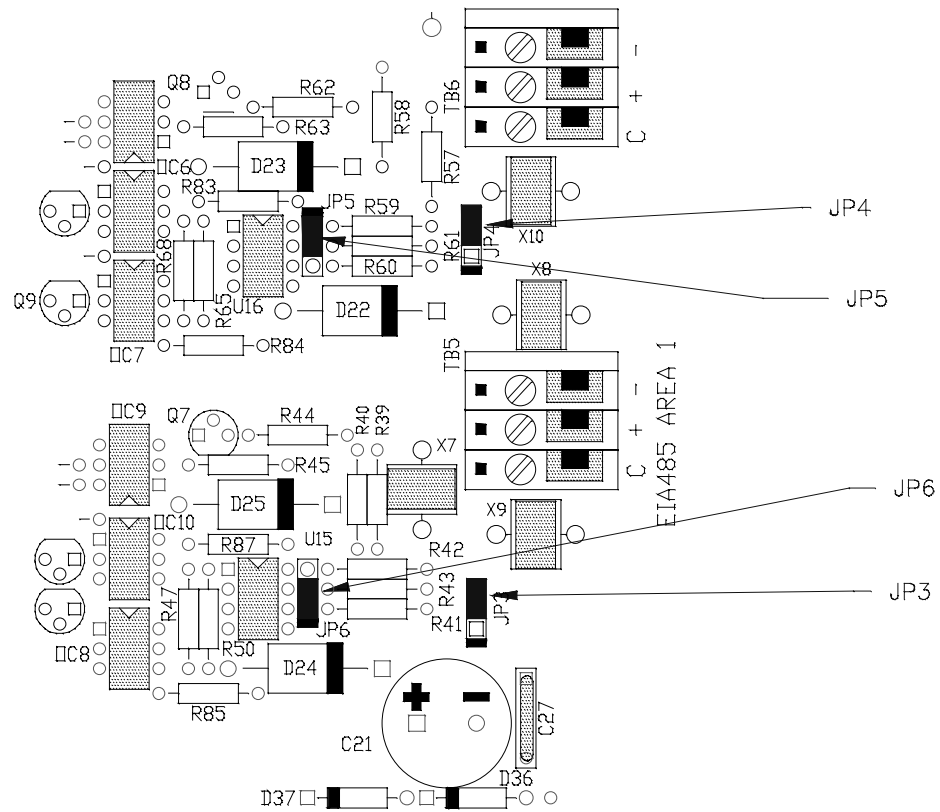
Figure 7 FIC Circuit Board Showing Jumpers Lower Left

Figure 8 FIC Circuit Board Showing Jumpers On Right

SECTION 3 - OPERATION

TankView To MFT

Host Computer RS-232 to EIA-485 Interface

This configuration provides two independent EIA-485 communication busses that can support up to 31 slave devices each. In this mode the poll message is broadcast out on both busses and the received reply from either bus is returned to the host. This requires that all of the slave devices, regardless of which communication bus, must have a unique address.

Control of the EIA-485 transmit enable can be jumper selected for either RS-232 RTS handshaking line control or an automatic mode that adds a 70 millisecond delay in the response time from each slave device. In the automatic mode, the FIC internally generates the RTS signal. The RS-232 host can then run in full duplex mode.

Figure 9 shows an example of two tank farm areas connected to a FIC. Each area may contain a maximum of 31 transmitters connected on a maximum of 5000 feet of cable. Recommended field cable is 18 AWG shielded, twisted pair for signal. An additional 18 AWG pair is required for power. Each MFT may draw 35 mA depending on HART devices.
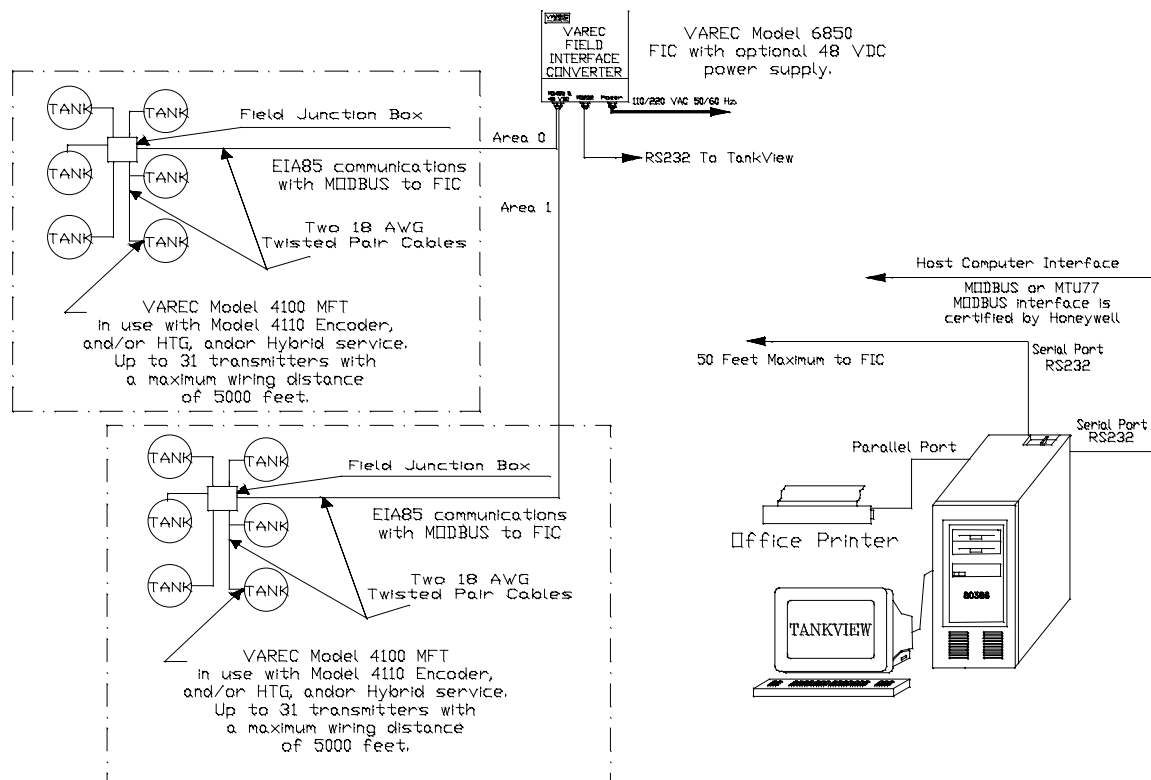

Figure 9 FIC Configuration with RS-232/EIA-485 Transmitters

Modem RS-232 to EIA-485 Interface

This configuration is similar to above except that instead of connecting directly to the host, the FIC is connected via full duplex modem. This mode allows the FIC to be located in a remote location.

In this mode of operation, the automatic transmit control mode jumper must be set ON. An additional set of three jumpers configure the FIC as either a DTE or DCE type RS-232 connection. What this means is that with this mode or the previous mode, the RS-232 wiring between the FIC and either host or modem is the same and there is no need for null modem adapters or custom cables.

The example shown in Figure 10 (top) shows one tank farm area connected to a FIC that in turn connects via a modem to the TankView station. Only one FIC field area is supported in this configuration.

Multi-drop RS-232 Host / Modem to EIA-485

This mode applies to the two prior configurations mentioned above. By setting two jumpers on the FIC board, it can share a RS-232 port from a host or modem with another FIC.

This expands the number of slave devices that can be supported from a single RS-232 port or allow the splitting up of the communication busses for greater system reliability. However, all the MFTs connected to one RS-232 serial port must have unique addresses. Up to four FICs can share one RS-232 serial port.

The example shown in Figure 10 (bottom) shows four tank farm areas connected to two FICs. The FICs each connect to TankView via a multi-drop RS-232 system.
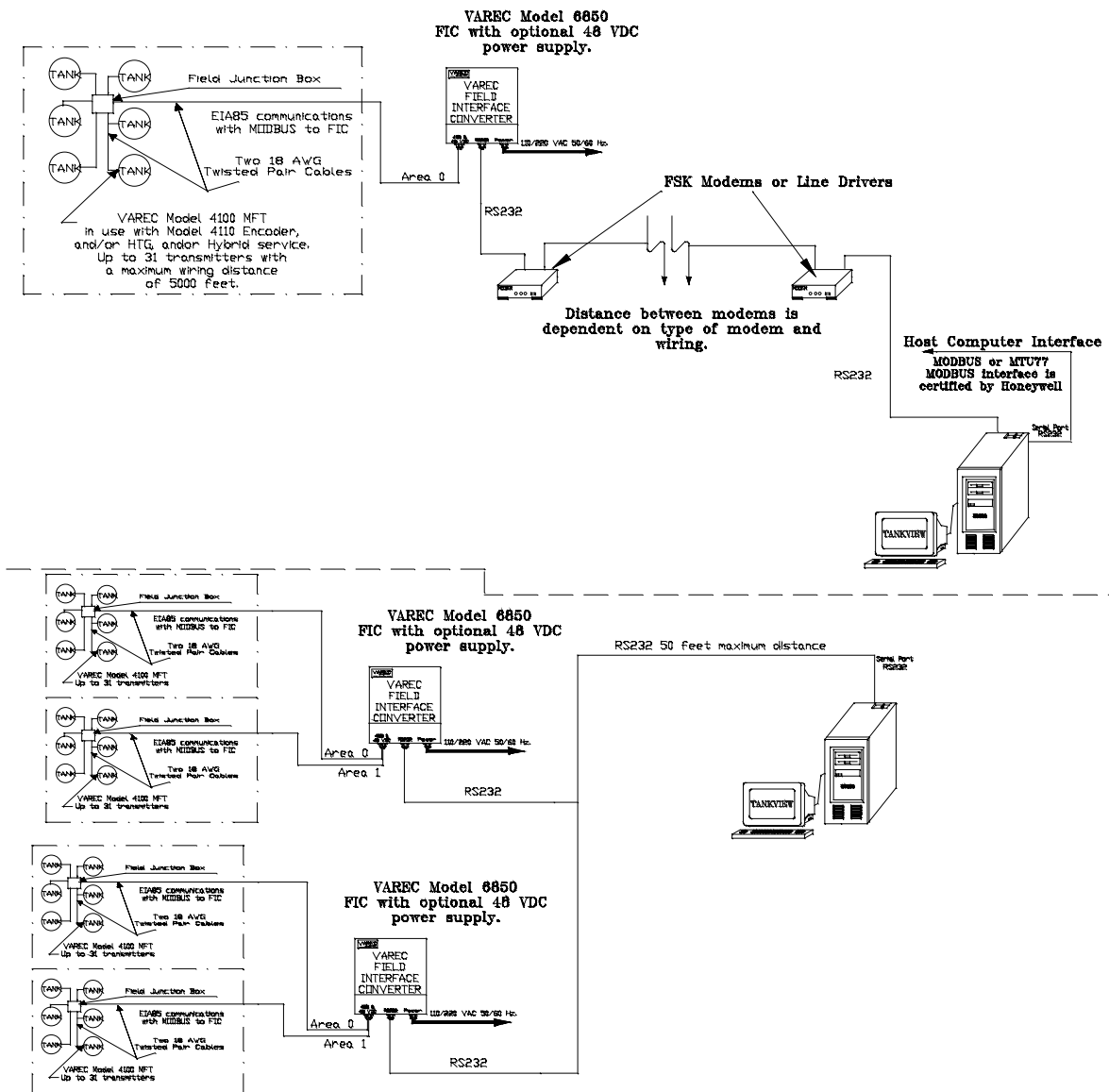
Figure 10 FIC Configuration with Remote EIA-485 and Multi-Drop RS-232

TankView To Whessoe

Host Computer RS-232 to Whessoe Bus Interface

This configuration provides two independent Whessoe communication busses that can support up to 32 ITG transmitters each. In this mode the RS-232 DTR handshaking line from the host controls which area is selected. This differs from the *broadcast mode* used for EIA-485 communication because the Whessoe bus communication protocol has a maximum addressing range of 32.

If the host software does not support DTR handshaking in this manner, then only one area will be supported (Area 0). In this mode the transmit control jumper must be set to automatic because the Whessoe transmitters do not have a defined response time. The additional 70 milliseconds that this introduces to each transmitter response time has a negligible impact on the overall system update rate.

Figure 11 shows an example of two areas of a tank farm connected to a TankView workstation using a FIC connected to the Intelligent Tank Gauge Model 50/60/70.
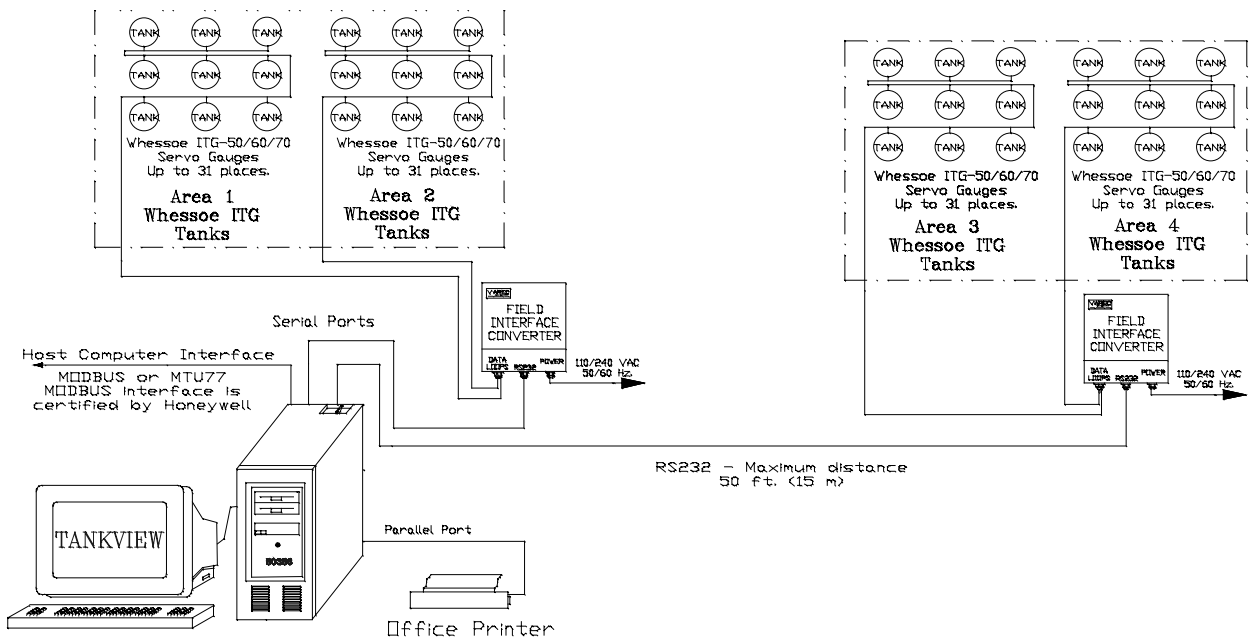

Figure 11 FIC Configuration with RS-232/Whessoe Bus

Figure 12 shows FICs connected to both communication channels of the ITG (Intelligent Tank Gauge). Each channel connects to a different TankView workstation.

CAUTION
Data altered within TankView stations and possibly downloaded to an ITG on loop1 will not cause data to be altered on stations connected to loop 2.
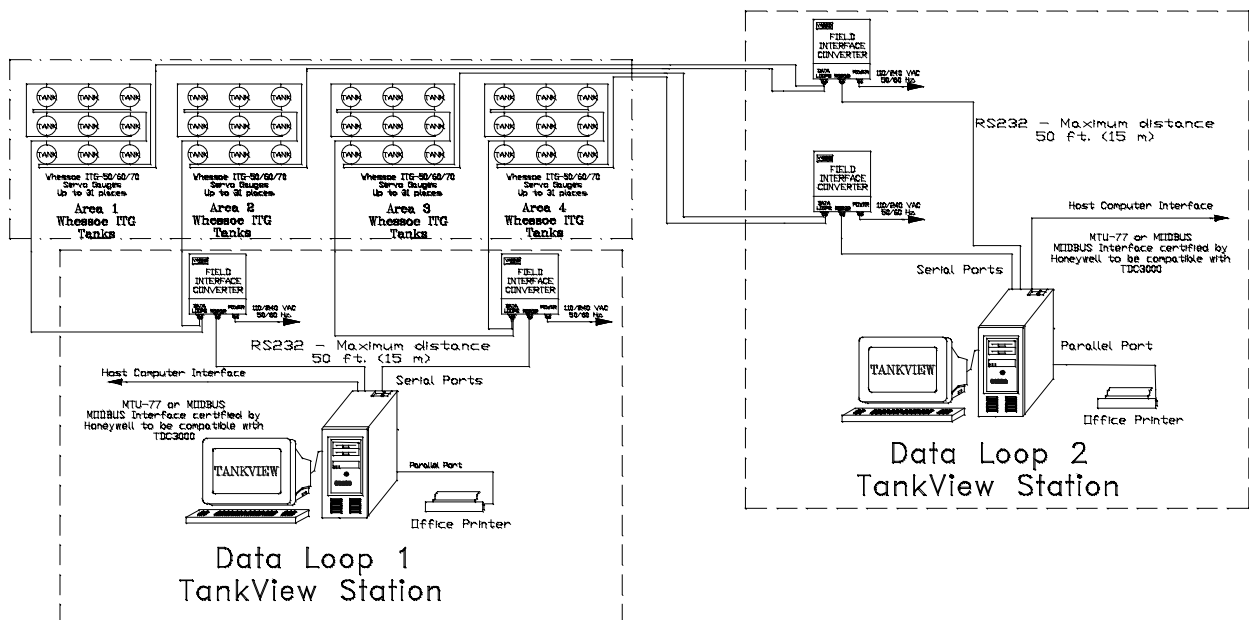

Figure 12 FIC/Whessoe Dual Communications

Modem RS-232 to Whessoe Bus Interface

This full duplex configuration is different from the previous one in the same manner as the modem to EIA-485 mode, except that only one Whessoe Bus area can be supported (Area 0). A modem can not be used to toggle the state of the DTR line and select the area. Figure 13 is an example of this configuration.

Multi-drop RS-232 Host or Modem to Whessoe Bus

This full duplex mode applies to the two prior configurations in the same way as for EIA-485 modes except that the number of transmitters that can be supported from a single RS-232 port does not increase. Reference Figure 13.

The only advantage of operating in this mode for the Whessoe Bus is the ability to split the Whessoe transmitters up into smaller isolated busses. This improves system reliability and maximum wiring distance to Whessoe transmitters.
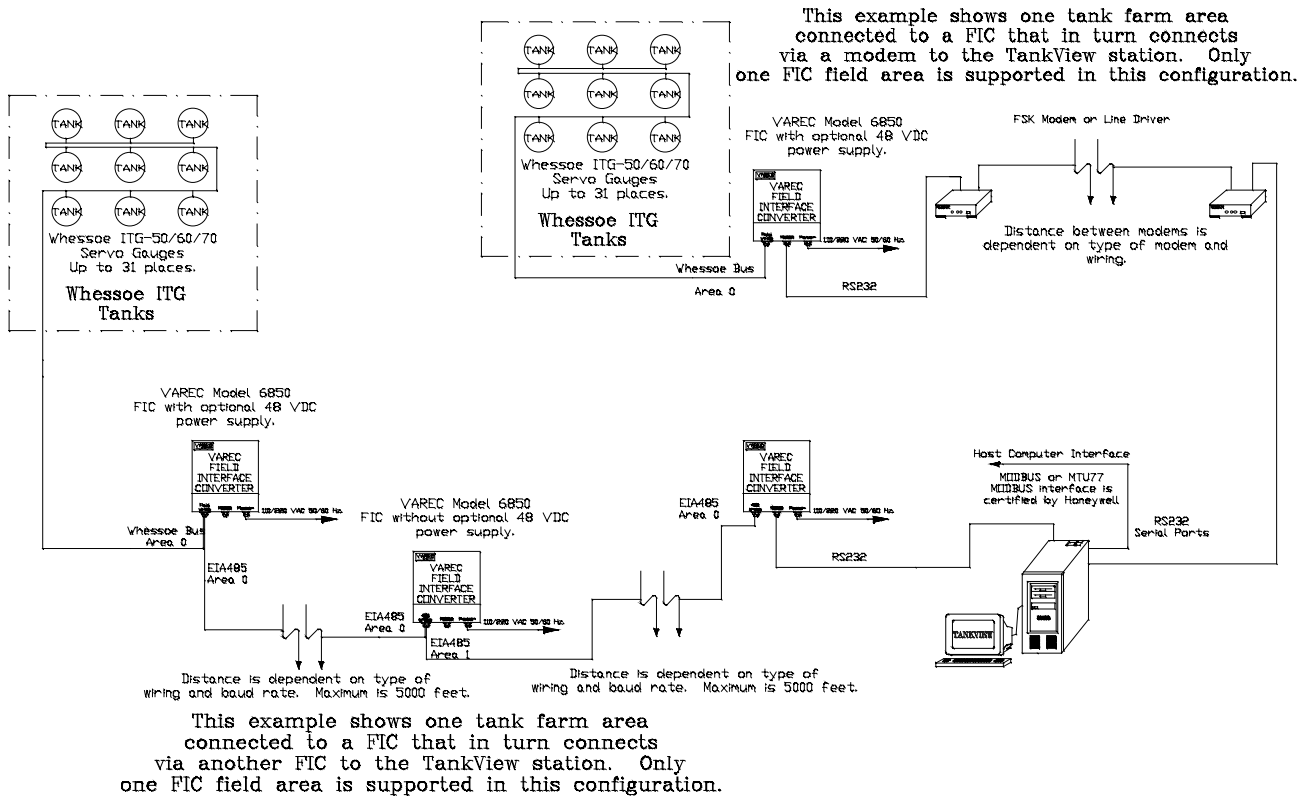
Figure 13 FIC With Modem to Whessoe Bus

EIA-485 to Whessoe Bus Remote Interface

In this configuration, the FIC is located in a remote location and serves as a long distance communication link between Whessoe Transmitters and a host EIA-485 communication port. In this mode of operation, only one Whessoe Bus area is supported, Area 0. Figure 14 shows use of the FIC as an EIA-485 repeater station.
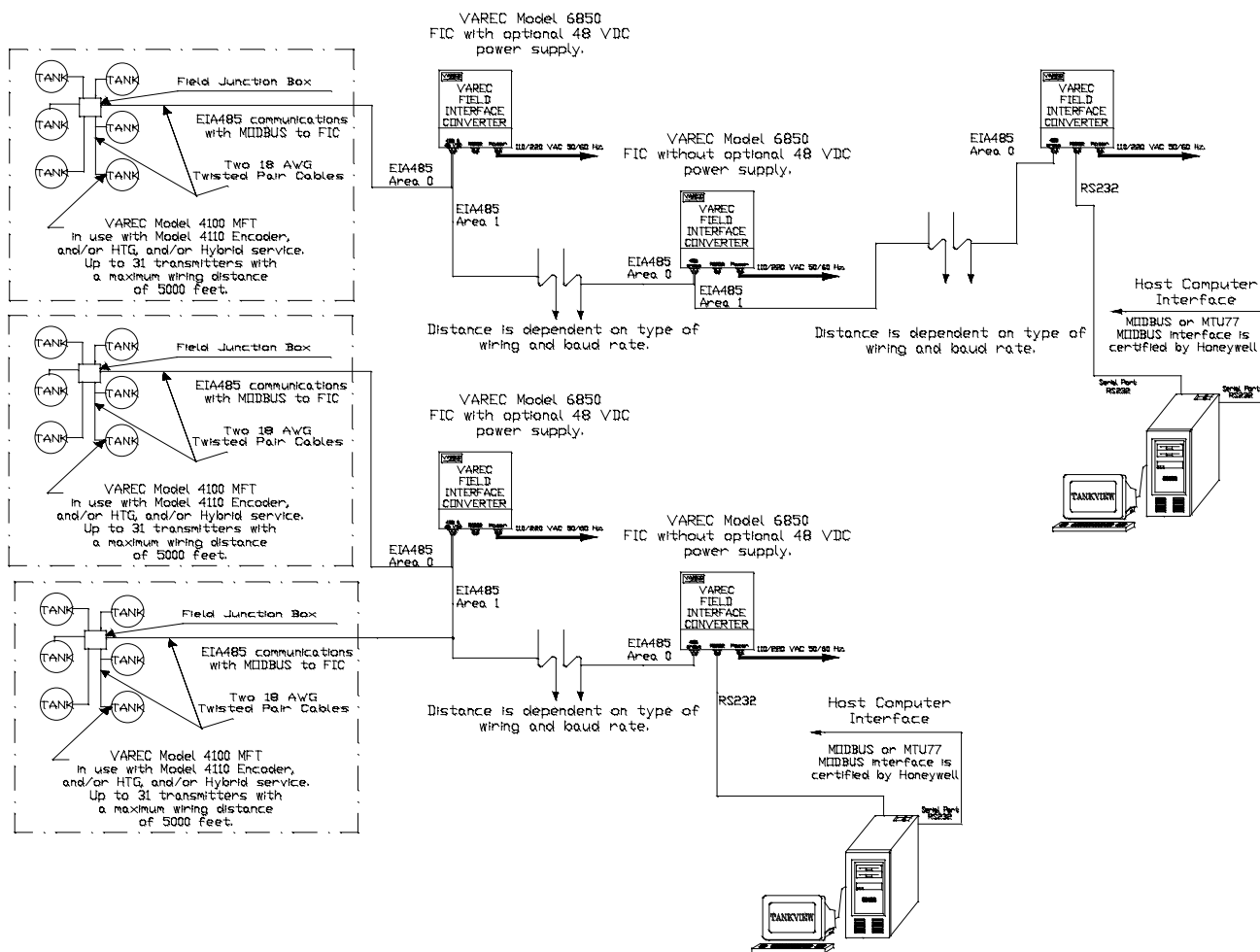
Figure 14 FIC As EIA-485 Repeater With Whessoe Bus

EIA-485 to EIA-485 Repeater / Booster

In this configuration, the FIC serves only to re-amplify the EIA-485 signal and extend the maximum distance between host and slave. Theoretically, any number of FICs can be connected to achieve virtually any distance. In this mode, each FIC adds 70 milliseconds to the response time of the slave. This mode also supports the addressing and connection of multiple EIA-485 devices, such as the Model 3401 Mark/Space Translator Unit.

Figure 15 shows the FIC connected to three Mark/Space Translator Units (MSTU). The EIA-485s from the translators are multidropped. The RS-232 connects to TankView. Up to 31 MSTUs can be connected this way.
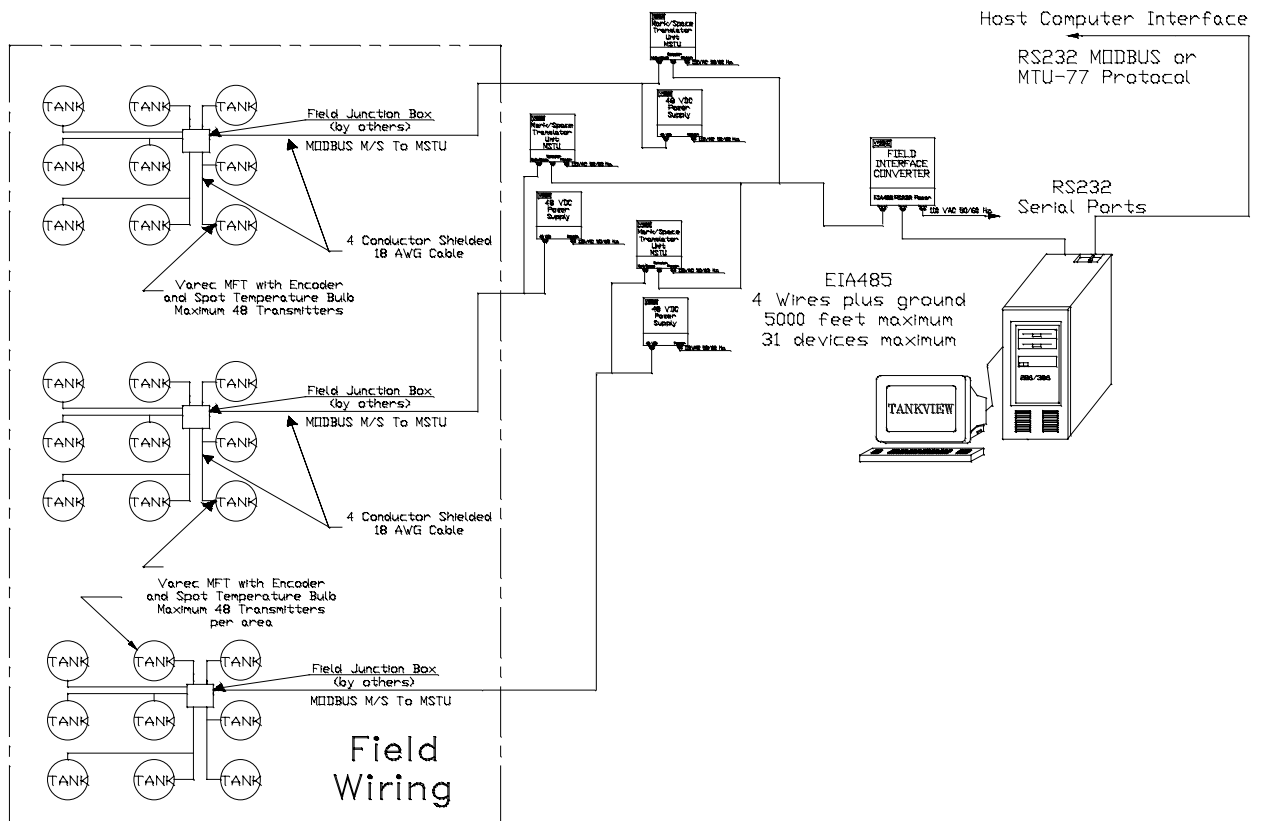
Figure 15 FIC As EIA-485 Repeater

SECTION 4 - MAINTENANCE AND SPARE PARTS

Field Repair

The FIC contains one printed circuit board and an optional power supply. Neither board is designed to be repaired by the customer. The Whessoe Varec Service Department has a program to swap boards to get a customer back on-line quickly.

Spare Parts

The FIC has the following spare parts:

- Circuit board for FIC   Part #08-09890
- Circuit board for power supply   Part #08-09900
- Cable to computer   Part #P120-02-077
- 220 VAC fuse, 1-1/2 Amp*   Part #P116-01-038
- 110 VAC fuse, 3 Amp   Part #P116-01-039

* One fuse is required for primary AC input. Two additional 1-1/2 A fuses are required.

SECTION 5 - SPECIFICATIONS

Physical Specifications

Housing: NEMA Type 4 wall mount enclosure
Dimensions: 20" high by 20" wide by 6" deep
Cable Entries: Two 3/4" and one 2" NPT entries
Weight: 50 lb. (27.5 kg)

Environmental Specifications

Temperature: -40 to +185 ^{o}F
                      (-40 to +85 ^{o}C)
Humidity: 0 to 95% non condensing
Isolation: Min. 2500 Volts RMS
Surge: Meets or exceeds ANSI/IEEE C62.41-1980

Input Power Specifications

Voltage: 110 VAC / 220 VAC, +/- 20% switch selectable
Frequency: 50/60 Hz
Current: Without optional 48 VDC power supply:
                        0.25 Amp at 110 VAC or 0.13 Amp at 220 VAC maximum
                      With optional 48 VDC power supply:
                        2 Amp at 110 VAC or 1 Amp at 220 VAC maximum

Output Power Specifications (Optional 48 VDC P/S)

Temperature: -40 to +85 ^{o}C
                      -40 to +185 ^{o}F
Voltage: 48 VDC
Current: 3 Amp - 1.5 Amp per area. 3 Amp total
Load Regulation: 1% zero to full load
Line Regulation: 1% over specified AC input range

Whessoe Bus Interface

Max. Loop Voltage: 70 VDC +/- 5% with automatic adjustment for number of
                      transmitters on the loop
Loop Current: 20 mA constant current source. +/- 1 mA
Baud Rate: 2400 Baud MAX
Isolation: 2500 Volts RMS

EIA-485 Bus Interface

Compatibility: Meets EIA-485 specifications
Isolation: 2500 Volts RMS

RS-232 Interface

Compatibility: Meets RS-232 specifications
Device Type: Jumper selectable for DTE or DCE
Multi-Drop Mode: ULCNET diode-OR implementation
Handshaking: Jumper selectable RTS transmit enable control or automatic.
DTR controls Whessoe Bus area select.