

Volume

1

SYN-TECH SYSTEMS, INC.

Home of the FuelMaster®

FuelMaster® ADC

Installation Manual

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FuelMaster®ADC Installation Manual

Revision 1

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Table of Contents

Introduction	3
Introduction	4
<i>System Architecture Overview</i>	<i>5</i>
<i>System Architecture Overview</i>	<i>6</i>
<i>Functional Description.....</i>	<i>6</i>
<i>ADC FM 2525 Retrofit.</i>	<i>7</i>
ADC Hardware.....	9
<i>Truck Interface Module (TIM).....</i>	<i>9</i>
<i>TIM LED's and Antenna Connection</i>	<i>10</i>
<i>Antenna Kit.....</i>	<i>10</i>
<i>LED's.....</i>	<i>10</i>
<i>Mounting Bracket</i>	<i>11</i>
<i>UIT - Bottom Panel Components.....</i>	<i>14</i>
<i>Right-side Panel Components.....</i>	<i>15</i>
<i>Desktop Download/ Charging Cradle</i>	<i>17</i>
<i>Optional External Battery Pack.....</i>	<i>17</i>
<i>Charging the Internal UIT Battery and External Battery Pack.....</i>	<i>18</i>
<i>ADC Receipt Printer.....</i>	<i>19</i>
<i>Pulser.....</i>	<i>20</i>
<i>Temperature Sensor.....</i>	<i>21</i>
UIT – TIM – Central Controller Hardware Installation	22
<i>Step 1. Connect the TIM</i>	<i>23</i>
<i>Step 2. Connect the Vehicle Charging Cradle</i>	<i>23</i>
<i>ADC Gumstix TCP Router.....</i>	<i>25</i>
ADC Router Windows Installation Instructions	27
ADC PC/RF Installation	29
<i>ADC Parts List</i>	<i>30</i>

Introduction

Syn-Tech Systems, Inc. has developed a ruggedized, intrinsically safe Personal Digital Assistant (PDA), for use in fuel dispensing applications for the aviation fueling community. This system includes various components that are used to provide user interaction, data input, and access control to issue points by controlling valves or deadman control systems. Collectively these components are known as the Fuelmaster® Automated Data Capture System (ADC). The ADC system has the ability to control dispensing of electric, hydraulic, and pneumatic actuated deadman control systems or by using an in-line valve configuration.

The purpose of this manual is to provide an explanation and description of all system components, as well as, guide the user in the operation of the system. If, during the use of this manual you have any questions, please contact FuelMaster's® Customer Service Department at 1-800-888-9136 ext. 252.

Figure 1 (Page 5), provides a high level overview of the ADC System Architecture, Interfaces and Ports & Protocols.

FCC Caution: Any change or modification to the product could void the user's authority to operate the device.

ADC System Overview

The ADC system requires more than just a UIT to control fueling.

Introduction

The ADC System User Interface Terminal (UIT) is designed to operate on Microsoft Windows CE. Windows CE provides an interface that will look and feel like your desktop PC and enables you to do the following:

- Authorize and record transactions using either a Prokee® or valid credit card.
- Access, view and edit transaction data.
- Download transaction data via a wireless-enabled or ActiveSync®-enabled Personal Computer (PC).

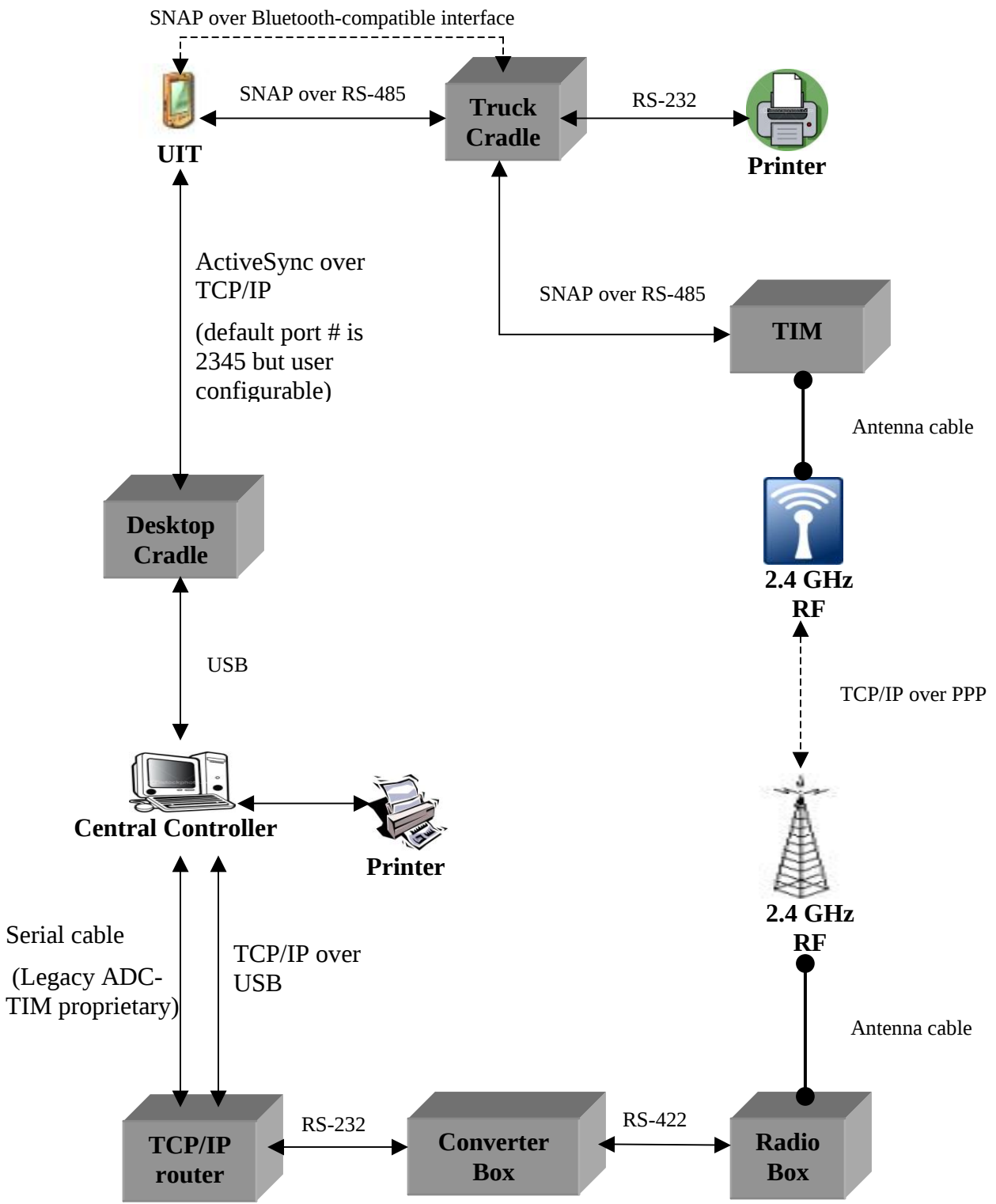
The UIT has a ruggedized exterior that allows credit card transactions, Prokee® transactions, or manual entry transactions.

The touch screen on the face of the UIT allows for easy data entry and navigation, utilizing the provided stylus via the keyboard or transcriber function.

ADC, Ledger and ActiveSync® software, as well as, the various ADC hardware components will need to be installed and/or configured on the Central Controller PC before transaction data will download into the Central Controller PC for export to Ledger or FAS. If FAS is to be used in the export process, then the FASAPI.dll file will need be loaded also.

In this chapter we will describe the various hardware components that make up the ADC system.

ILLUSTRATION 1 – ADC SYSTEM ARCHITECTURE



System Architecture Overview

The UIT communicates with the vehicle-charging cradle via a 3DES Encrypted Bluetooth-compatible interface (wireless) or a serial (RS-485) connection if wireless connectivity is unavailable or prohibited (software configurable). Once a wireless connection has been established from the UIT to the cradle, SNAP (Scaleable Node Address Protocol) is used for passing data between the UIT and other devices on the SNAP bus. Currently, these devices include the receipt printer, the Truck Interface Module (TIM), and the vehicle-charging cradle. The UIT is also capable of docking in the desktop cradle to form an ActiveSync connection via USB with the central controller. The receipt printer is a node on the SNAP bus, for which all decoding of data packets is done within the vehicle-charging cradle and sent to the printer via RS-232. The printer can receive data from any device on the SNAP bus. The TIM is connected to the vehicle-charging cradle via RS-485 and is another node on the SNAP bus. The truck charger simply passes data between the UIT and printer to the TIM. The decoding of SNAP packets destined for the TIM is done within the TIM itself. To communicate with the central controller, the TIM establishes a PPP connection to the TCP/IP router via its 2.4GHz radio. The router then forwards the packets retained in the TIM to the central controller via a TCP/IP over USB connection.

Functional Description

User Interface Terminal (UIT) – a handheld device for inputting data from the user, magnetic stripe card, Prokee® and other source media. It is also a terminal for executing, configuring, and monitoring a fuel transaction via the TIM.

Vehicle-Charging Cradle – routing device for directing data packets between the TIM, UIT and the printer using SNAP over either RS-485 or Bluetooth. This device also provides power to the UIT for charging and operation.

Printer – printing device used to print transaction receipts. It can receive data from both the TIM and UIT through the vehicle charging cradle.

Truck Interface Module (TIM) – Establishes and maintains a connection to the UIT and central controller to account for fueling transaction data by monitoring the accumulated fuel quantity and temperature. It controls all external interfacing to the truck and fueling equipment including the hose(s) and pulser(s). Transactions reside here and are uploaded to the central controller via a 3DES Encrypted internal 2.4 GHz radio. The TIM also provides power to the printer, vehicle-charging cradle and other devices.

Base Station (PC/RF Assembly) – houses the 2.4 GHz radio for the central controller and the **Converter Box**, which provides power and a logical interface to the radio box from the computer's serial port and an auxiliary power supply.

TCP/IP router – routes data from multiple (New) ADC TIMs to the USB port on the Central Controller. Also routes (Legacy) ADC/FDS TIM data to the serial port of Central Controller for legacy ADC support.

Central Controller – computer that stores transactions from multiple new and old systems then uploads them to FCC-FMD/FAS software. It also controls TIM and UIT configuration.

Desktop Cradle – provides interface for syncing UIT with Central Controller to download transactions and other data as well as uploads configuration data. It also provides power to charge and operate the UIT.

ADC FM 2525 Retrofit.

Illustration 2, on page 8, shows the devices and interconnections required for retrofitting the ADC System into an existing FMU-2525 site.

[illegible]

ADC Hardware

Truck Interface Module (TIM)

The Truck Interface Module (TIM) sits between the peripheral sensors (temperature and pulse) and the Vehicle-charging cradle. The TIM initiates and records information about transactions, such as quantity and current fuel temperature. The TIM also maintains equipment information, such as; equipment number, grade of product, transaction sequence count, etc.

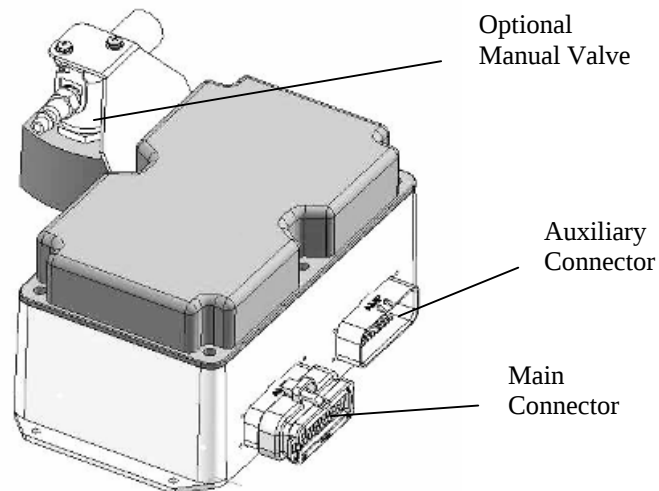


Figure 1 – Truck Interface Module (TIM)

Main Connector	The main connector uses a 35-pin connector and cable bundle to connect the TIM to the peripheral sensors. Only the main connector is used with single hose hydraulic and pneumatic applications. Both connectors are used with electric deadman control systems regardless of the number of hoses.
Auxiliary Connector	The auxiliary connector is used in addition to the main connector for use with electric deadman control systems and for controlling up to 4 additional hoses, temperature sensors and pulsers.
Optional Deadman Control Valve	The TIM comes with an internal electrical circuit control, but an optional external valve can be provided to support deadman control.

TIM LED's and Antenna Connection

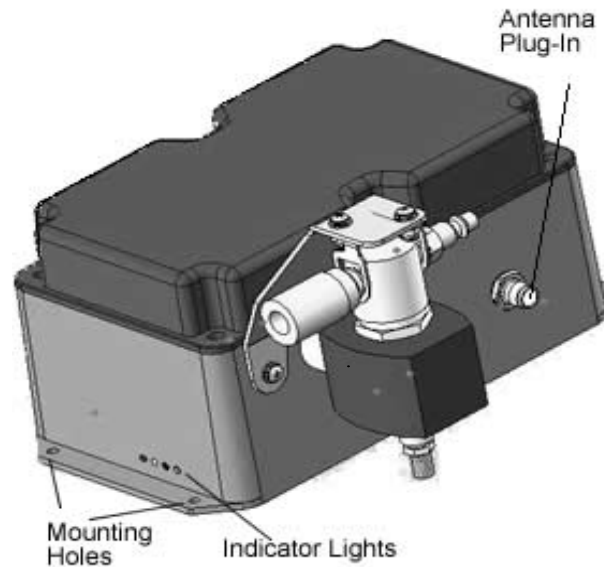


Figure 2 - TIM Indicator LEDs and Antenna connector

Antenna Kit

The Antenna Kit (981A0270) installation contains the coaxial cable with attached antenna. The antenna is used in the RF transmitting of transaction data back to the Central Controller PC. The antenna is mounted on the outside of the truck and for better reception, ideally above the top of the truck cab. The antenna coax cable is then fastened into the connector on the outside of the TIM box. (See figure 2)

LEDs

Power (Right)	The power LED is the rightmost LED and when illuminated green indicates 12 volts DC present.
Heartbeat (Center)	The heartbeat LED when flashing green indicates that the TIM processor is operational.
Radio (Left)	The radio LED when illuminated red indicates a radio link is established between the TIM and the Central Controller PC.

Mounting Bracket

Though the TIM housing (lower enclosure) provides mounting holes on flanges molded onto the enclosure, it is strongly recommended to install the TIM mounting bracket. The mounting bracket would be installed first and the TIM will merely slide into the bracket for a secure mount. Wherever possible, employ the TIM mounting bracket. This will avail ease in installation, upgradeability and if necessary, quick replacement of the unit.

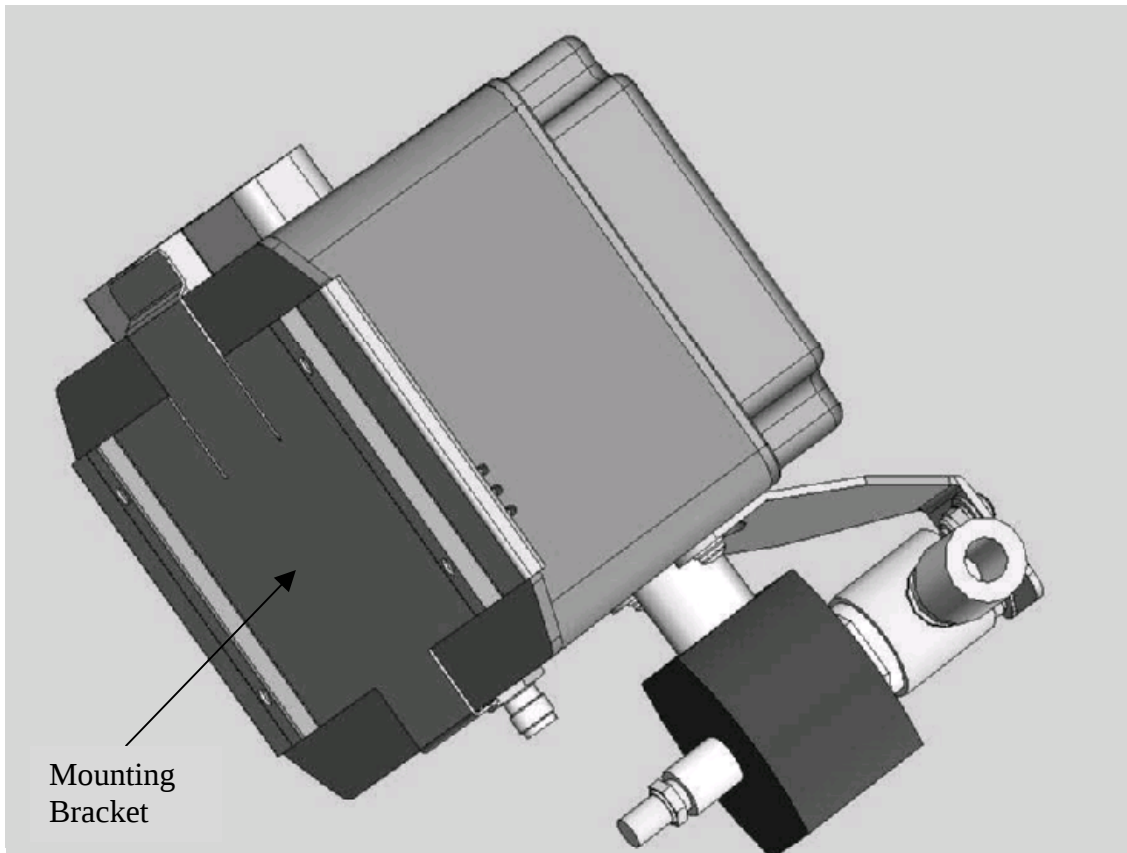


Figure 3 - TIM with Mounting Bracket

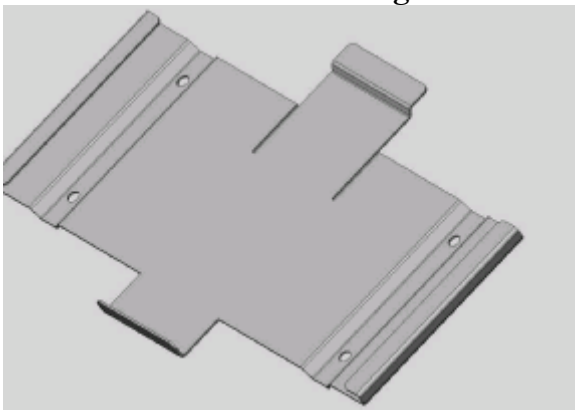


Figure 4 - Mounting bracket

Truck Interface Module (TIM) Components

The 2-part **Enclosure** houses the circuit boards and a **Baffle** to hold the circuit boards in place.

The **Backplane** circuit board provides connectors for the Processor board, RF board, Barrier cable and the TIM Console connector.

The **Processor Board** contains the TIM software and firmware. The processor controls all transactions, monitors dispensed fuel, and calculates temperature compensation. It also stores transaction and authorization data and controls sending transaction data to the ADC Central Controller via the RF transceiver board. It also has a reset button and hosts a 64mb or greater capacity compact flash card.

The **RF Transceiver** board uses spread spectrum frequency hopping technology in the 2.401-2.495 Gigahertz range. The board's function is to establish wireless communications with the ADC Central Controller.

An optional **Manual Air or Hydraulic Valve** is also available for non-electric controlled applications.

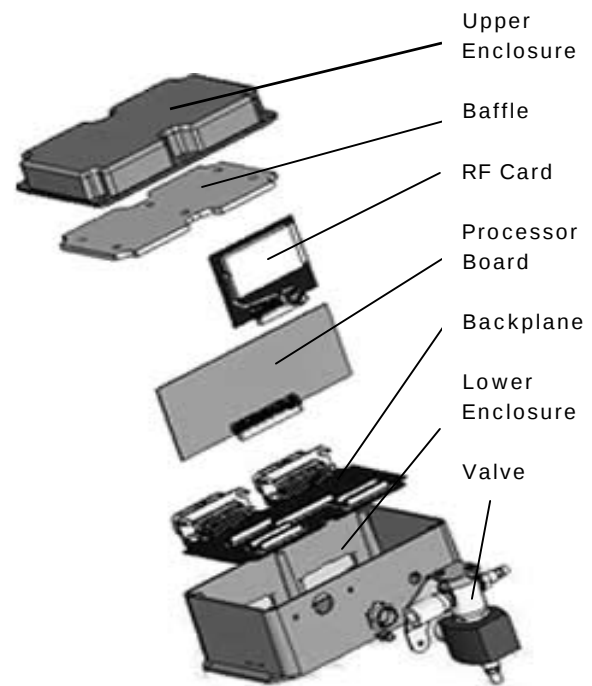


Figure 5 - TIM Components

UIT Front Panel Components

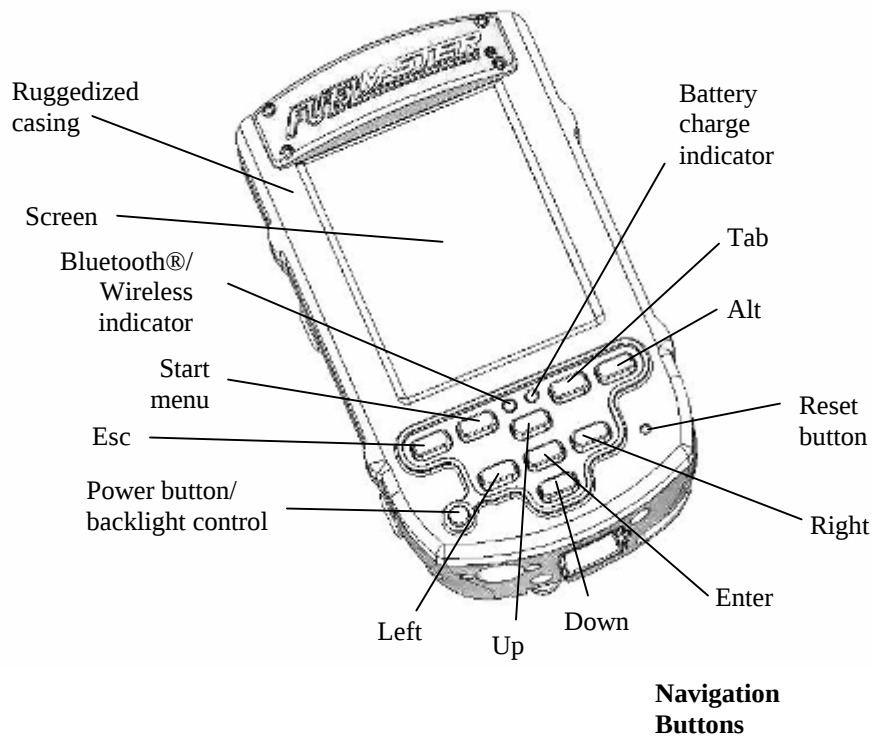


Figure 6 – UIT Front Panel

Ruggedized casing	The ruggedized, non-sparking outer casing provides the durability needed in the fuels environment.
Screen	The 240 x 320 pixels, 16-bit color, touch screen displays the applications and information stored in your UIT. Information is input via a stylus.
Battery charge indicator	Multicolored LED that displays the current battery charge. A green light indicates that the UIT battery is at greater than 50% capacity and is therefore fully charged. An orange light indicates that the battery is between 30% and 50% capacity and needs to be charged as soon as possible. A red light indicates that the battery charge is at a critically low level and should be charged before being used further.
Bluetooth® / Wireless indicator	When glowing blue, indicates that the wireless link or Bluetooth® radio is active and is communicating with the vehicle-charging cradle.
ESC (A) key	Use the <i>Esc</i> button to stop a function in process.
Start Menu (B) key	Displays the Windows CE Start menu.
TAB (C) key	Moves the cursor from one field to another, or

ALT (D) key	moves from one menu to another. At present, this key turns the Bluetooth radio on or off.
Enter (Center) key	Accepts the current selection.
Navigation buttons	The navigation buttons – up, down, left and right – allow the user to navigate around the screen.
Power button/ backlight control	Turns the UIT on or off.
Reset button	Resets the UIT. Under normal use, you should not have to use the reset button.

UIT - Bottom Panel Components

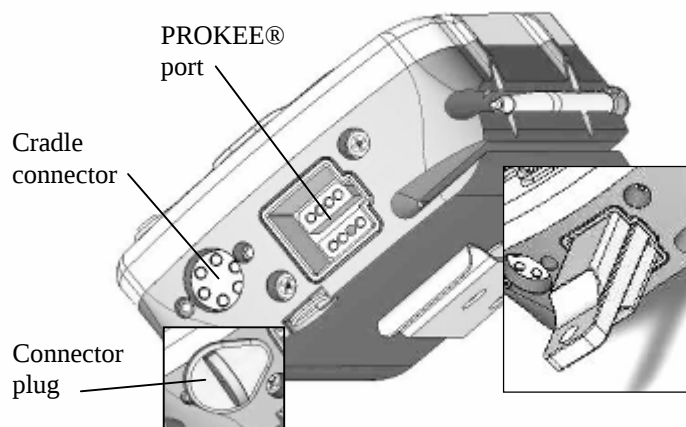


Figure 7 – UIT – Bottom Panel Components

Cradle connector	Connects the UIT to either the vehicle-charging cradle or UIT Desktop cradle. The UIT Desktop Cradle connects to a USB port on the PC and to the AC power adapter. The vehicle-charging cradle connects to the TIM. The UIT will recharge from either cradle type.
Prokee® port	The Prokee® port accepts any encoded vehicle, supervisor or manual issue Prokee®.

Right-side Panel Components

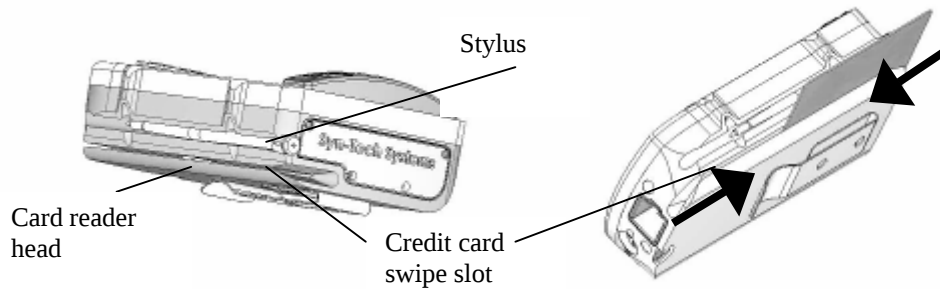


Figure 8 – Right-side Panel Components

Magnetic card swipe slot

Reads information from a standard formatted magnetic swipe card (credit card) and inputs the data into transaction data fields on the UIT screen. The slot is bidirectional; credit cards can be swiped from the top towards the bottom, or from the bottom towards the top. The magnetic stripe of the card must face up and towards the front panel of the UIT where the card reader head is located.

Stylus

Attached to the UIT via a lanyard assembly. Slides in and out of the slot at the top of the UIT. Used for information input on the touch screen display.

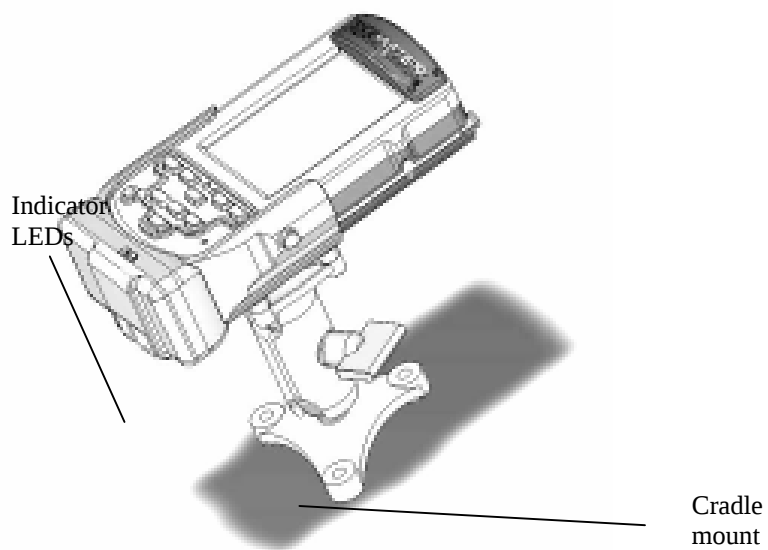


Figure 9 – Vehicle-Charging Cradle & Mount

Vehicle-Charging Cradle mount

Enables the Vehicle-Charging Cradle to be attached to a convenient location, such as the dashboard of a truck.

Indicator LEDS

The right LED when illuminated green indicates power. The left LED when illuminated blue indicates an active Bluetooth® wireless connection with the UIT.

Desktop Download/ Charging Cradle

Use the PC Cradle to download transactions serially to the Central Controller Software and to recharge the unit.

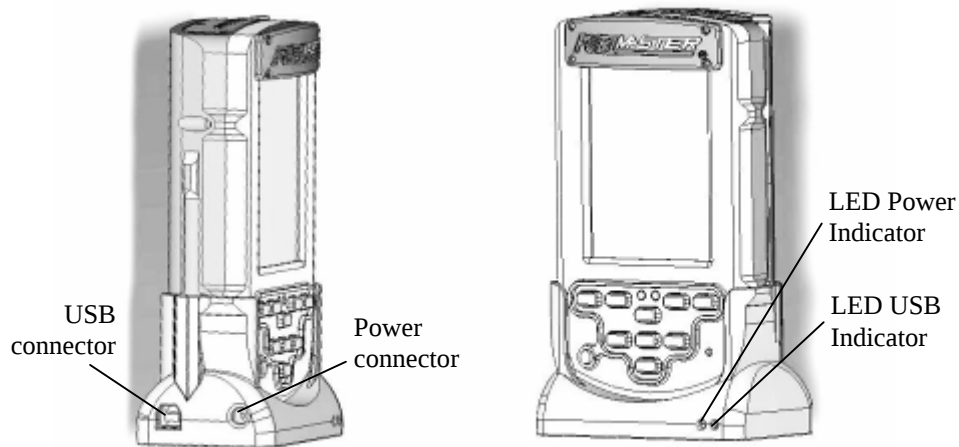


Figure 10 – Desktop Download/Charging Cradle

USB connector	Connect one side of the USB connector cable into the Desktop Download/Charging Cradle. Plug the other side into the USB port on your computer.
Power connector	Connect one side of the power connector into the Desktop Download/Charging Cradle. Plug the AC adaptor into a working electrical outlet.
Indicator lights	The left light is red and indicates power; the right light is green indicates an active USB connection.

Optional External Battery Pack

The ADC System supports an optional, external, battery pack, which is used to recharge or sustain the internal battery of the UTT.

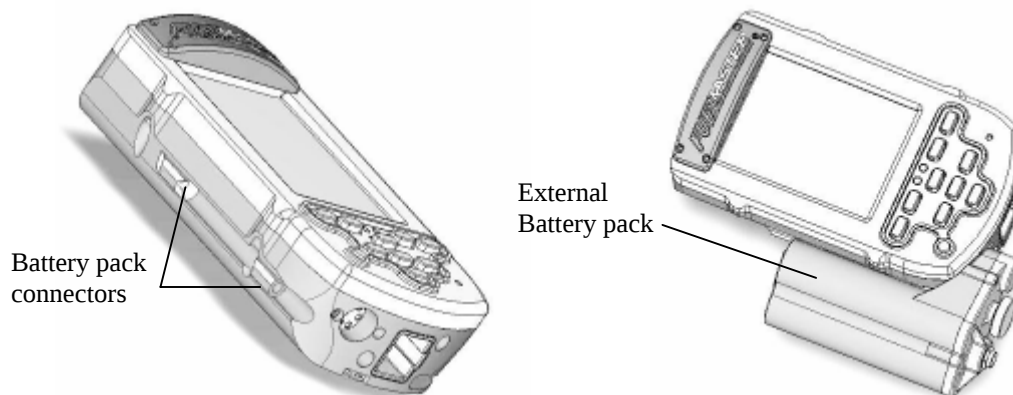


Figure 11 – External Battery Pack

Charging the Internal UIT Battery and External Battery Pack

It takes approximately 4 hours for a completely drained internal battery to charge to 90% capacity from a powered desktop cradle. Then it will switch to trickle charging which takes about additional 5 hours to charge to 100%. The UIT can be left on desktop cradle as long as desired.

After fully charged, an internal battery can last up to 12 hours in stand-by mode. Battery life is dependent on use but an internal battery can last between 3 – 12 hours. Max battery capacity is 2200mAh.

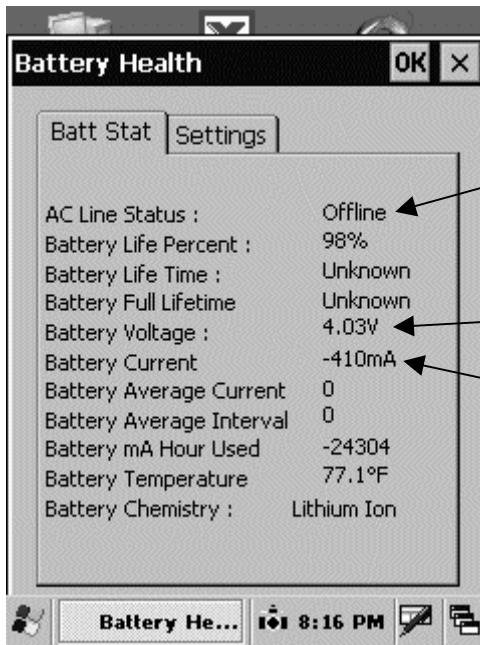
It takes approximately 5 hours to charge the external battery pack to 90% capacity and another 5 hours of trickle charging. Battery capacity in external battery pack is 6600mAh. After fully charged, an external battery can last up to 6 months in stand by mode. It takes approximately 6 - 7 hours for a fully charged external battery to charge a drained internal battery to 90% of its capacity.

An UIT can run between 15 – ** hours when a fully charged external battery is attached to the UIT with a fully charged internal battery. Once again, battery life is dependent on the use of the UIT.

The UIT internal and external batteries are Lithium Ion and have none of the memory effects seen in rechargeable Ni-Cd batteries. “Memory effect” refers to the reduced discharge capacity seen in rechargeable batteries when they are repeatedly discharged incompletely and then recharged.

When the UIT is placed in either the Desktop Download/Charging Cradle or the Vehicle Charging Cradle it will begin the charging cycle.

The status of the UIT internal battery can be checked by selecting the Battery Health program. This is accessed from the UIT graphical user interface, via the Microsoft® Windows CE “Start” menu by selecting the “Batt Stat” function.



AC Line Status indicates the UIT is either Online and in a charging cradle or Offline and out of the cradle running on the internal battery.

Battery Voltage is the voltage value present in the battery.

Battery Current indicates the charging cycle condition of the UIT battery. A negative value denotes the discharging interval of the cycle.

Figure 12 - Battery Health / Batt Stat

ADC Receipt Printer

The graphics capable thermal receipt printer is a fully hot pluggable print mechanism that permits the user to connect or disconnect the printer while powered without damaging the unit. The unit prints at 8 dots resolution mm/s and possesses a high-speed mode of 50 mm/s. The printer is capable of printing text, graphics and barcodes. The printer can communicate via serial or parallel communications protocol and has inherent self-test capabilities.

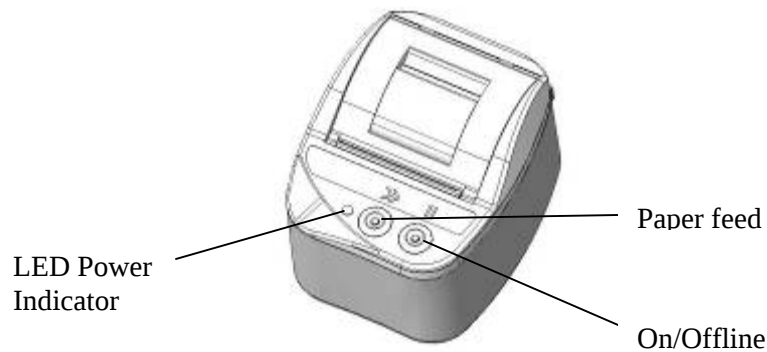


Figure 13 – ADC Receipt Printer

LED Power indicator	On when the printer is powered.
Paper feed	Push the paper feed button to feed paper through the printer.
On/Offline	Push the On/Offline button to pause printing. Push the button again to resume printing.

Pulser

The ADC system supports a variety of pulsers to ensure compatibility with all types of mechanical and digital meters. Also, the system can utilize a uni-directional or bi-directional pulser or can integrate existing GFE pulsers. All pulsers are rated intrinsically safe.

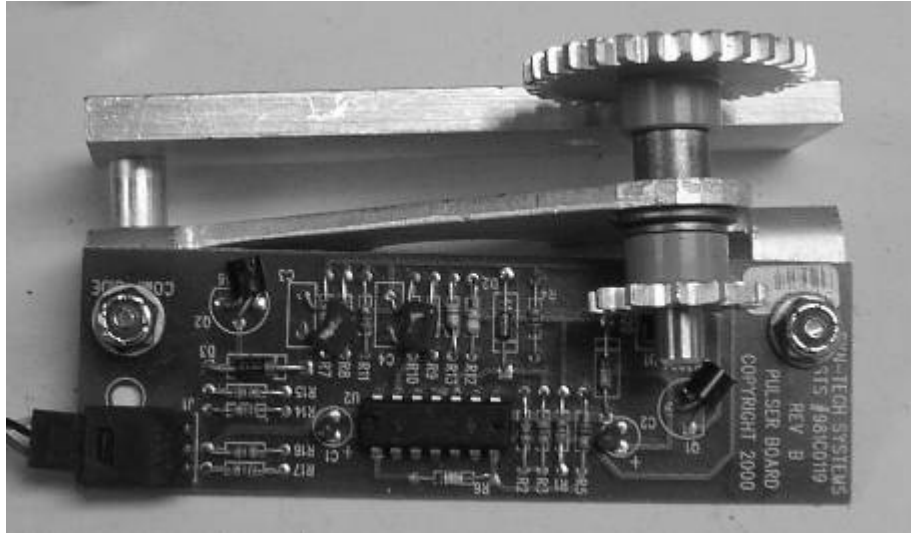


Figure 14 – Uni-Directional Pulser

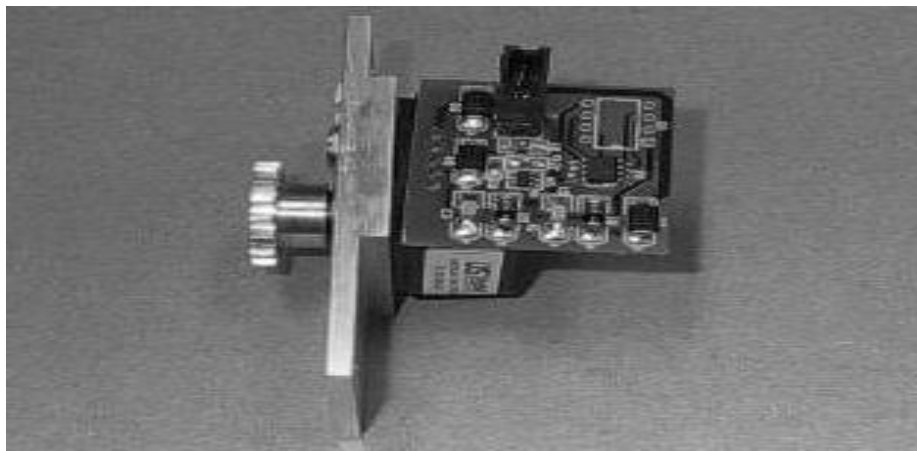


Figure 15 – Bi-Directional Pulser

Temperature Sensor

The PDA system utilizes a thermal sensitive, fuel temperature sensor that is connected to the TIM via an intrinsically safe barrier. The PDA system records temperature compensated fuel to 60 degrees Fahrenheit (15 degrees Celsius) and requires no fuel system component intrusion for installation.



Figure 16 – Thermal Temperature Sensor

The temperature sensor's flat bottom surface should be attached to a clean metallic surface on an input or output plenum as close to the refueling equipment's fuel meter as possible. The sensor should be securely wrapped with Scotch brand Electrical Moisture Sealant tape D.C.I. # 06147 and secured with two 16-inch zip ties.



Figure 17 – Temperature Probe Assembly

ADC Hardware Installation

Preliminary considerations: Since the dominate application of the ADC system involves R-11 refuelers, the following provisions have been disclosed for installation guidance and adherence. Unless

Note: The following steps are observed as standard practice in the system installation of DoD application and adherence to procedures is not subject to alteration.

Preparation: Preliminary survey. To begin with, decide on the location in the truck cab the bracket/TIM combo will permanently reside. For vehicle applications, locate a suitable mounting area in the cab typically behind the seat. shipped equipment inventory and inspection, guidance, observed standardizations, etc.

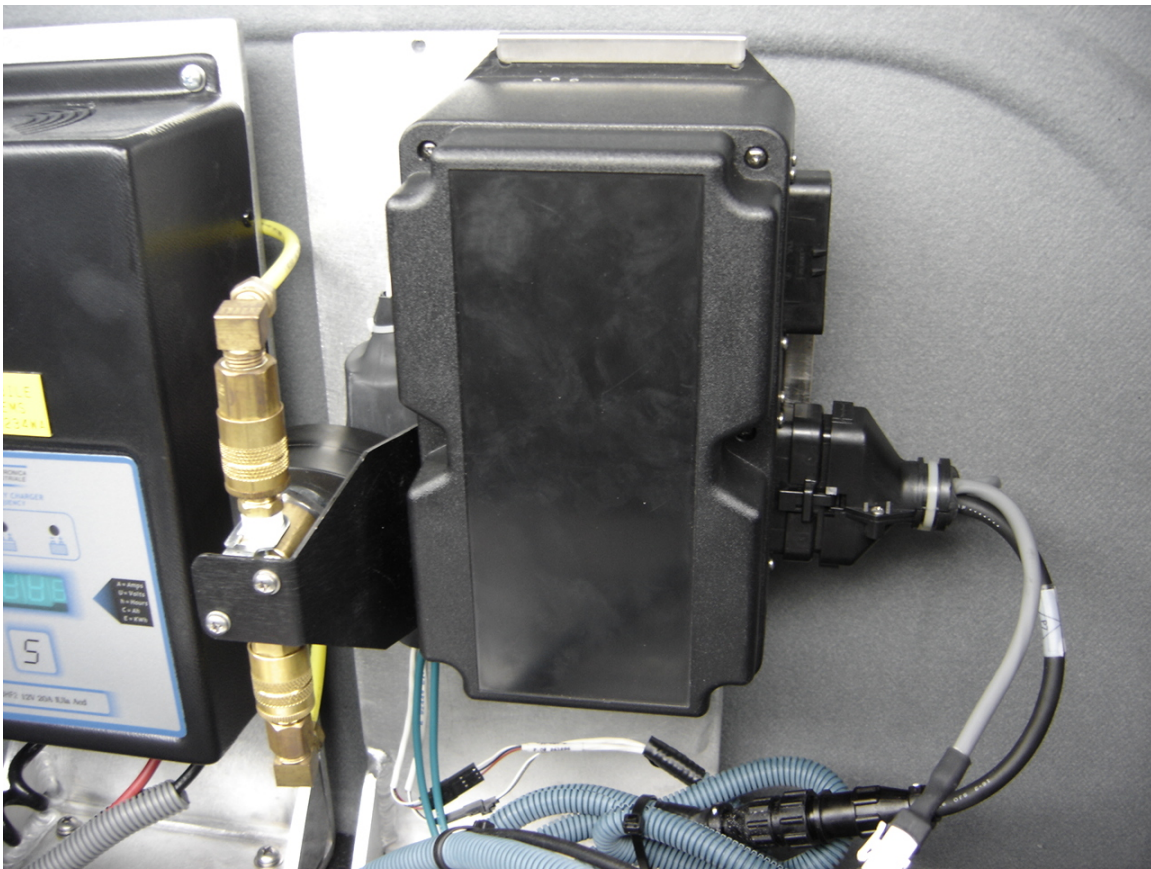


Figure 18 – TIM vehicle cab mount

Mount & Connect the TIM

- Mount the TIM within close proximity of the pre-determined Vehicle Charging Cradle mount location. The TIM must be within 20 feet of the Vehicle Charging Cradle.
- Using the mounting bracket as a template, drill four holes into the desired surface location. (Some applications will use self-tapping screws, so pre-drilling will not be necessary). Using the provided hardware, install the bracket and slide the TIM into the bracket.
- Assemble antenna kit (part # 981A0200) and install the assembly to the pre-determined antenna mount location.
- Connect the antenna threaded coaxial connector to the threaded coaxial connector on the TIM. *Note: It is strongly recommended that the TIM coaxial connector be prevented from turning while fastening the antenna cable connector. Damage to TIM internal connections can occur if TIM connector is allowed to turn while attempting this connection.*
- Insert the cable bundle connector (part # 032C0344) into the Main connector port on the TIM (see Figure 1) ensuring that the latching mechanism locks the two connectors securely.

Install & Connect sensors and cabling

- Fasten the green ground leads of the Temp-Pulse/Interface or barrier cable (part # 981D0114) to a chassis ground and connect to TIM cable assembly (part # 032C0344).
- Install Pulser to flow meter register.
- Install Temperature sensor or Temperature probe (see Figure 16 & 17) to plenum or prescribed location.
- Connect pulser sensor cable (part #981D0117), and temperature compensation sensor cable (part # 981D0118/032E0107) to TIM cable assembly (part #032C0344).
- Wire the TIM 12 Volt DC Power cable (part # 981D0105) to an external power source and connect to TIM cable assembly (part #032C0344).
- Gather any excessive slack in cabling and secure in a neat manner using cable ties, wire loom, etc. Be sure to allow for cable tension relief during installation.

Mount & Connect the Vehicle Charging Cradle

- Mount the Vehicle Charging Cradle in a location that is within 20 feet of the TIM.
- Connect the Charger and Data Bus Cable (part # 032C0346) from the TIM cable bundle to the Vehicle Charging Cradle.
- Connect the ADC Printer (part # 032C343) cable to the back of the Vehicle Charging Cradle and into the ADC Printer (if so equipped).

- o Place the UIT into the cradle for a minimum of two hours for the initial charge. The UIT indicator light will glow steady green when it is charging.
- o After UIT is charged, remove by gently pulling it straight up and out from the cradle.

ADC Communication Verification

The following test sequence determines connectivity between devices for the ADC system. Initially, the UIT handheld unit must be charged to capacity as described on page 18.

TIM Communication

- a. On side of TIM verify that LED indicators are illuminated as described on page 10.
- b. UIT input of TIM ID
- c. Truck Cradle Bluetooth recognition LED
- d. TIM LED reply
- e. DoDFM AE Aviations Transactions Table, Active Ledger

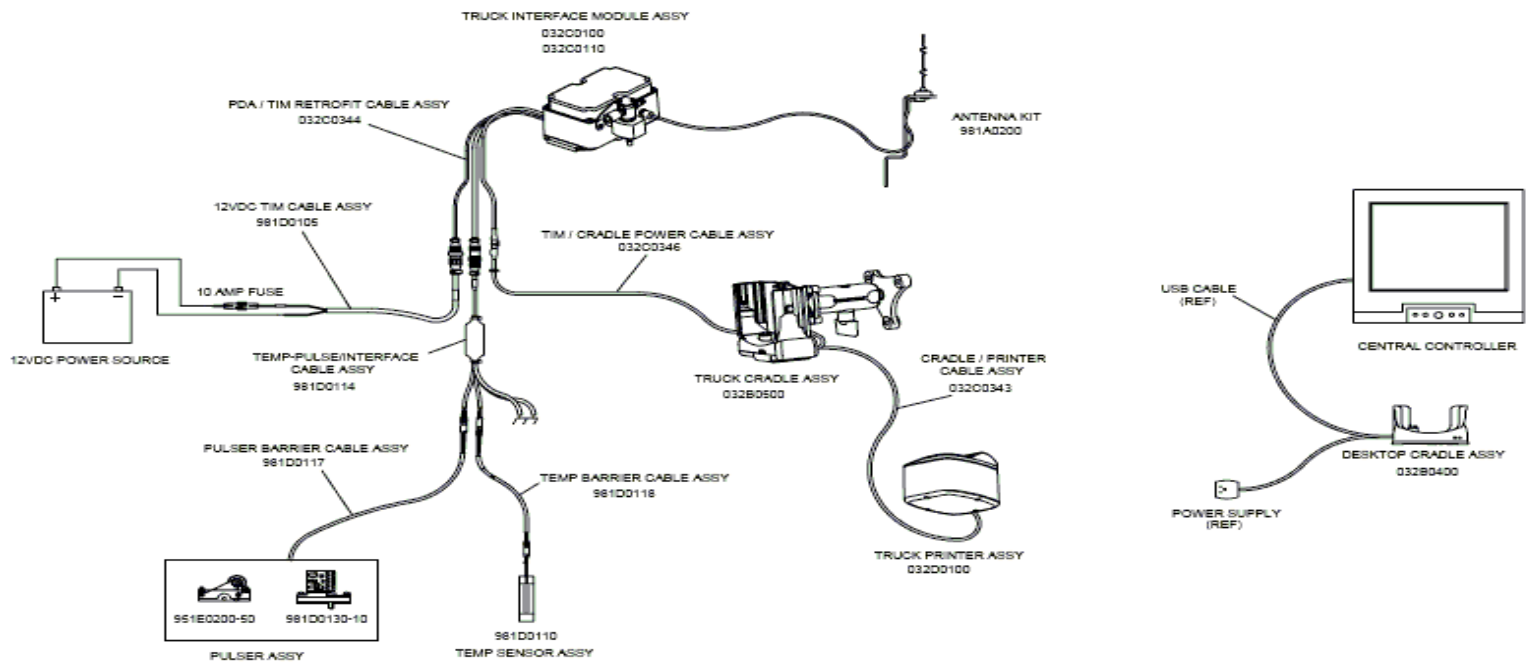


Illustration 3 - ADC System Component Equipment

ADC Gumstix TCP/IP Router

The Gumstix ADC Router is the intermediary between the TIM and central controller via the radio. It provides a PPP server for TIM connectivity. This allows for a seamless TCP/IP connection between TIM and central controller.

It is across the TCP/IP Bridge that the TIM sends database entries directly to the Central Controller.

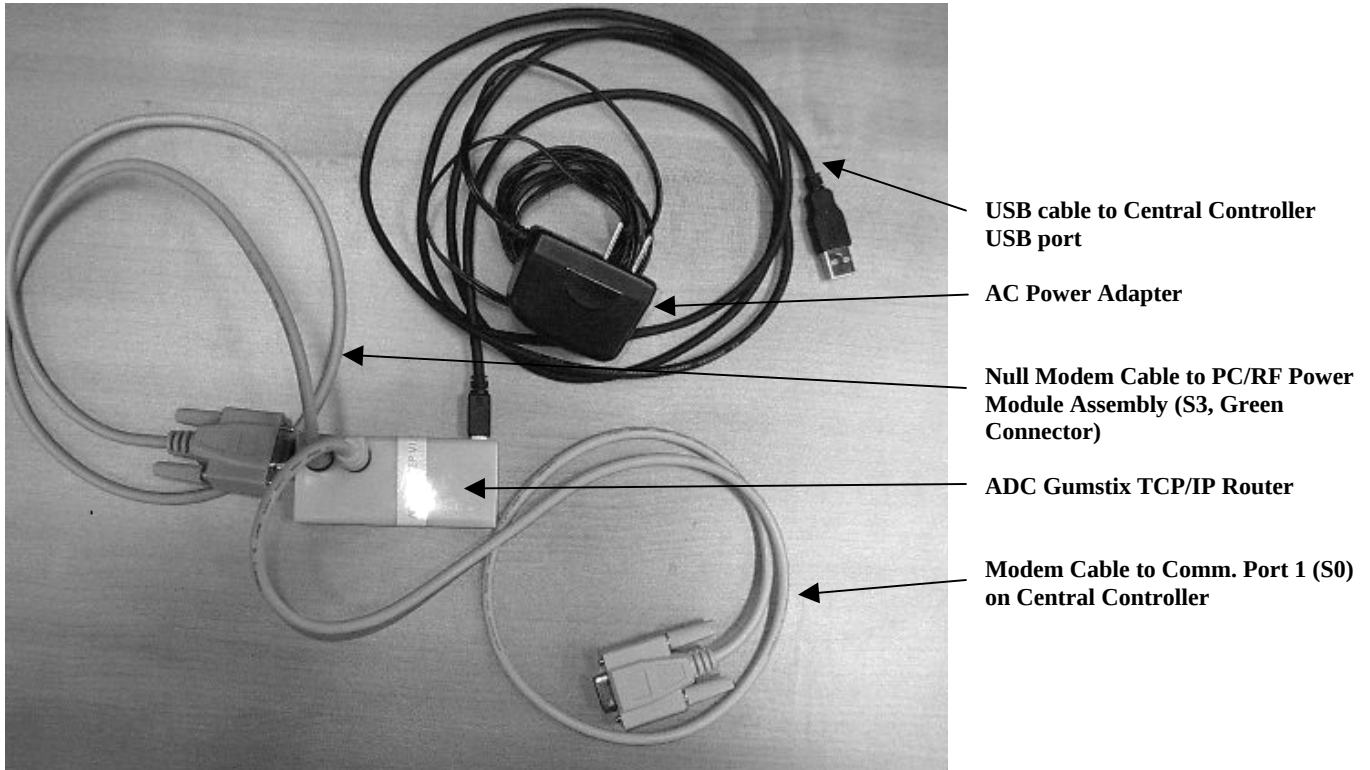


Figure 19 – ADC Gumstix TCP/IP Router

ADC Router Windows

Installation Instructions

Installing the ADC Gumstix TCP/IP Router

- 0 Connect router to ADC PC/RF power module via serial 8-pin Mini Din Male (green) to DB9 Male RS-232 cable into 8-pin Mini Din Female port of router to ADC power module.



8-pin Mini Din Male

via serial cable & gender adapter.



- 0 Ensure device connected via RS-232 serial Null Modem cable to serial I/O port on computer and remaining DIN port on router.
- 0 Ensure Gumstix TCP/IP router connected via USB cable to Central Controller USB port.
- 0 Verify power connector from transformer connected to router
- 0 Verify USB Ethernet connection status from Windows: Start > Settings > Network Connections. Look for Linux USB Ethernet/RNDIS Gadget # listed among connections (Win OS plug-n-play should identify and associate device network connections)
- 0 Highlight local area connection associated with Linux USB Ethernet connection then, left button mouse click or select File -> Properties -> <highlight> Internet Protocol (TCP/IP) -> Properties.
- 0 Select: "Use the following IP address:" <type> 192. 168.54.2 in "IP address:" {field} and 255.255.255.0 in "Subnet mask:" {field}
- 0 Verify connectivity out from the host computer: Start > Run...> cmd. At command prompt <type> ipconfig <return>. IP Address 192.168.54.2; Subnet Mask: 255.255.255.0
- 0 Verify connectivity to Gumstix from host computer. Start > Run...> cmd. At command prompt <type> ping 192.168.54.3 <return>. Packets: Sent = 4, Received = 4

Set-up the IP address of the USB network connection in the MS Windows® environment:

- a. Go to: control panel → network connections
- b. Right click the USB connection → properties
- c. Select "Internet Protocol (TCP/IP)" from scroll box under the general tab → properties
- d. Select "Use the following IP address:"
- e. Enter: IP address: 192.168.54.2, Subnet mask: 255.255.255.0
- f. Hit OK twice to save settings and close the network connection properties dialog

ADC Router Connectivity Verification Instructions

To verify router connectivity out from the host computer port:

- a. Right click the USB connection → Status
- b. Confirm under General tab that the number of data packets sent and received are not zero

Alternative method

To verify connectivity out from the host computer port:

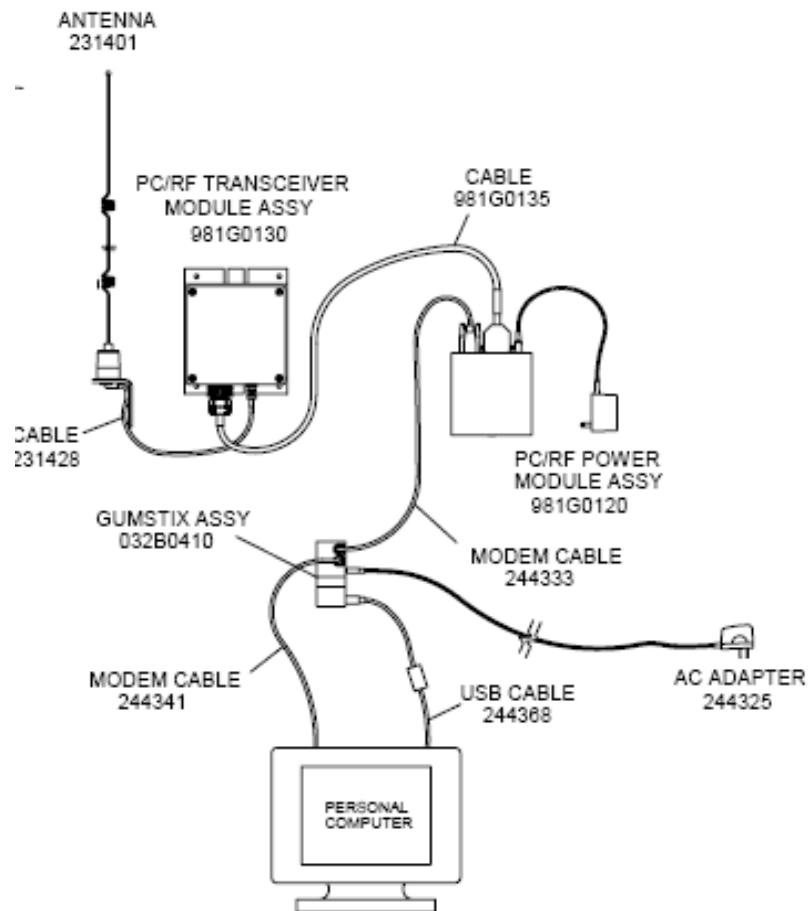
- a. Select: Start → Run... → type **cmd** in Open: field → OK
- b. At command prompt type: **ipconfig** and press Enter key.
- c. Confirm returned message: "IP Address 192.168.54.2; Subnet Mask: 255.255.255.0"

To verify connectivity from TCP/IP router from host computer:

- a. Select: Start → Run... → type **cmd** in Open: field → OK
- b. At command prompt type: **ping 192.168.54.3** and press Enter key.
- c. Confirm returned message: "Packets: Sent = 4, Received = 4"

ADC PC/RF Installation

Illustration 4 - ADC PC/RF Installation



ADC Parts List

[illegible]

Pin #	MAIN Connector (left) pin outs	Pin #	AUX Connector (right) pin outs
1	Battery Positive (Gold Contacts)	1	Battery Positive
2	Battery Ground	2	Ground
3	Ignition Positive	3	Hose Control Output 1
4	AIM Power	4	Hose Control Output 2
5	UIT Power	5	Hose Control Output 3
6	Temperature Sensor Chassis Ground	6	Hose Control Output 4
7	Temperature Sensor 1 or RTD 1	7	eTPU_9_ADC Valve Drive
8	Temperature Sensor 2 or RTD 2	8	eTPU_10
9	Temperature Sensor 3 or RTD 3	9	eTPU_11
10	Temperature Sensor 4 or RTD 4	10	
11	Relay1_IN	11	Relay2_IN
12	Relay1_NO	12	Relay2_NO
13	Pulser input 1	13	General I/O 1
14	Pulser input 2	14	General I/O 2
15	Pulser input 3	15	General I/O 3
16	Pulser input 4	16	General I/O 4
17	Ground	17	General I/O 5
18	Debug Serial Port RS-232 RX	18	General I/O 6
19	Debug Serial Port RS-232 TX	19	General I/O 7
20	Debug Serial Port Ground	20	General I/O 8
21	AIM Connection RS-232 TX	21	General I/O 9
22	AIM Connection RS-232 RX	22	General I/O 10
23	AIM Connection Ground	23	Ground
24	Pulser Positive power supply	24	Ground
25	Pulser Ground power supply	25	Ground
26	PDA Ground	26	RS-232 TX to Printer
27	AIM Ground	27	RS-232 RX to Printer
28	General I/O 7	28	Battery Positive
29	General I/O 8	29	Battery Positive
30	General I/O 9	30	Battery Positive
31	General I/O 10	31	Battery Positive
32	I2C Data Line	32	Battery Positive
33	I2C Clock Line	33	I2C Data Line
34	RS-485- to PDA Cradle	34	I2C Clock Line
35	RS-485+ to PDA Cradle	35	Ground

Appendix A: Table of Figures

This appendix shows the figures that are used throughout the manual and the pages they can be found on.

Throughout this manual, there are screenshots and figures used as examples of the user interface. This appendix contains a list of those figures and the pages where they can be located.

If you are in need of more support or have a question that is not contained in this manual, please contact Fuel Master's industry leading help desk at (800) 888-9136 ext. 252 with any questions you may have.

Figure 1 – Truck Interface Module (TIM).....	9
Figure 2 – TIM LED's and Antenna plug.....	10
Figure 3 – TIM with Mounting Bracket	11
Figure 4 – Mounting bracket.....	11
Figure 5 – TIM Components.....	12
Figure 6 – UIT Front Panel.....	13
Figure 7 – UIT – Bottom Panel Components	14
Figure 8 – Right-side Panel Components	15
Figure 9 – Vehicle-Charging Cradle.....	16
Figure 10 – Desktop Download/Charging Cradle	17
Figure 11 – External Battery Pack.....	17
Figure 13 – ADC Receipt Printer.....	19
Figure 14 – Uni-Directional Pulser.....	20
Figure 15 – Bi-Directional Pulser	20
Figure 16 – Thermal Temperature Sensor	21
Figure 17 – Temperature Probe Assembly	21
Illustration 3. - ADC System Component Equipment	25
Figure 18 – ADC Gumstix TCP Router.....	26
Illustration 4. - ADC PC/RF Installation	29