Smart-Alek® V2X Field Instrument

Installation Guide

MNL-V2X-2 V2X Field Instrument Installation Guide August 2011

zedi

Proprietary Rights Notice

Copyright Notice

Warranty

zed.i solutions inc. warrants this product, the Smart-Alek®, against defects in material and workmanship for a period of *one year* from the date of purchase from zed.i solutions inc. or an authorized zed.i solutions inc. agent or distributor. This warranty applies only to the original purchaser of the Smart-Alek® and is not transferable.

This warranty covers only defects arising under normal use and does not cover malfunctions or failures resulting from abnormal wear and usage, abuse, misuse, inadequate preventative maintenance, unsuitable environmental conditions, problems with electrical power, negligence, non-authorized modifications, or installation of non-authorized parts without prior knowledge and written permission from zed.i solutions inc. This warranty does not extend to damage to the product resulting from improper installation or operation, accident, or misapplication, nor as a result of service to the product by anyone other than zed.i solutions inc. or an authorized agent. This warranty does not extend to wear or damage of wetted parts.

Warranty claims require the return of the product to zed.i solutions inc. within the warranty period. Upon inspection by zed.i solutions inc., any parts found to be defective in material or workmanship will be repaired or replaced by zed.i solutions inc., at its sole option, without charge for parts or labour. Round trip transportation of products for warranty claims to zed.i solutions inc. repair facility is at the expense of the purchaser.

zed.i solutions inc. SHALL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS, DAMAGE, OR EXPENSE DIRECTLY OR INDIRECTLY ARISING FROM THE CUSTOMER'S USE OF OR INABILITY TO USE THIS PRODUCT, EITHER SEPARATELY OR IN COMBINATION WITH OTHER EQUIPMENT.

zed.i solutions inc. reserves the right to make changes to this warranty without notice and to make changes in design or additions to or improvements in the Smart-Alek® or any accessory items without obligation to make such changes or to install such additions or improvements in any equipment manufactured prior to the introduction of such changes.

zed.i solutions inc. makes no warranties, express or implied, verbal or otherwise, other than as expressly provided in the above warranty.

Regulatory Information

NOTE: Electromagnetic Interference (EMI) - United States FCC Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense

NOTE: Electromagnetic Interference (EMI) - Canada

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference causing equipment standard entitled 'Digital Apparatus,' ICES-003 of the Department of Communications.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norm sur le matériel brouilleur: 'Appariels Numériques', NMB-003 édictée par le ministre des Communications.

WARNING

FCC RF Exposure Guidelines

While this device is in operation, a separation distance of at least 20 cm must be maintained between the radiating antenna and the body of all persons exposed by the transmitter to meet FCC exposure guidelines.

Safety Considerations

You must have the proper training to safely install the Field Instrument, as required by applicable federal, provincial, and/or state law.

Additionally, your company also may have safety training program requirements which must be met for instrumentation issues, particularly pressure line installation safety procedures.

Also:

- only work in a location known to be non-hazardous, i.e., by declassifying the zone.
- use hand tools, hand power tools, testing equipment and specialty tools required by the trade.
- ensure you have the proper knowledge and understanding of operating processes and their interrelationship with instrumentation, including:
  - Installing, inspecting, testing, servicing and removing instruments.
  - Installing and removing pneumatic tubing, process tubing and piping.
  - Installing, inspecting, testing, disconnecting and connecting electrical wiring to instrument installations.
  - Incorporating modification to systems and components.
  - Installing, servicing, calibrating and maintaining equipment for calibration, reference or comparison standards.

If you are unsure about any part of the installation, consult an authorized and qualified person at your company, e.g., the Safety Supervisor.

Contact zed.i Client Services and Support if you have any questions.

CAUTION

Review, understand, and follow all company Safety Policies and Safe Work Procedures before you perform any work at the site.

CAUTION

Make sure that equipment is rated to the maximum pressure being applied.
If it is not, you could damage the equipment, or cause harm to yourself.

CAUTION

Obtain all required safety certifications before performing any work at the site, e.g., H_2S Alive, First Aid, etc.

CAUTION

Follow all applicable federal, provincial and municipal health and safety standards (e.g., Occupational Safety & Health Administration (OSHA) standards in the USA, Occupational Health and Safety (OHS) standards in Canada).

CAUTION

Wear Personal Protective Equipment (PPE) that is appropriate to the work site.

Smart-Alek Installation in an H_2S Environment

When you are installing the Smart-Alek Field Instrument in an H_2S environment, all of the tubing, valves and fittings must accommodate constant exposure to H_2S. Use of carbon steel equipment is not recommended.

Prior to applying gas to the equipment, or releasing gas to the atmosphere:

- Use the two-man rule. NEVER perform any work alone.
- Have a personal H_2S monitor and make sure the level is never higher than the federal, provincial and state regulations allow. If the H_2S level exceeds this, use the appropriate air system. For example, wear a supplied-air system (SAS).

CAUTION

- Wear Personal Protective Equipment (PPE) that is appropriate to the work site.
- Follow all applicable company safety policies and procedures, including all standard H_2S Safety Procedures.
- Have H_2S Safety Training.
- Be aware of wind conditions and that you are never downwind of the gas.
- Have a 5-minute Escape Pack for an emergency situation, as required by the operating company.
- Have a First Aid Kit.

Protecting from Electrostatic Discharge (ESD)

CAUTION: Static Sensitive Device(s).

Contains components susceptible to damage from Electrostatic Discharge. Handle only using static preventive processes.

A portable static-protective field service kit is the service technician's first line of defense against static. A static-safe work station is a work area in which static charge has been controlled. For conductors, this is accomplished by grounding. However, a charge on nonconductors, such as plastics or synthetics, cannot be removed by grounding. It must either be neutralized by exposure to ionized air or the objects must be physically removed from the area.

In a plant or depot environment, you can permanently safeguard a work station against static by installing grounded static-dissipating table mats and floor mats, conductive wrist straps, static-shielding bins and containers, ionized air blowers and appropriate caution signs.

However, sensitive electronic parts also are at risk when being handled by field service technicians, and they must be properly protected as well.

A portable static-protective field service kit consists of two basic components:

- a grounded wrist strap for the technician to wear
- a grounded mat to use as a static-free work surface.

Of the two, the wrist strap is the more important, because the human body is the greatest generator of static electricity. A conductive wrist strap that is properly fitted and grounded will not only remove any existing static charge from the wearer, but also prevents the generation of any new charge caused by normal movement. The other component of a static-protective field service kit is the work surface. During the course of a service call, a technician must periodically lay down the parts being handled. Setting sensitive electronic components on the carpet, floor tile or a nearby table top could easily result in catastrophic damage to the devices, because these surfaces all can build up and hold high levels of static charge. The field service kit work surface helps avoid this problem. Once the mat has been properly grounded, it remains free of static charge, and any sensitive parts laid upon it will be protected. The mat should be large enough to accommodate most PC boards or assemblies, yet be small and lightweight enough so that it can be carried between job sites.

For further information, try the ESD Association (http://www.esda.org).

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Chapter 1

Introduction

CAUTION: Static Sensitive Device(s)

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This Field Instrument must be installed as per drawing 14525.

Introduction

zedi Client Services & Support

For installation set-ups, customer service calls.

- During office hours: **403.444.1100**.
- After Hours and Toll Free: **1.866.732.6967**.
- If a zed.i representative is away or unavailable, follow the prompts on the automated call service or press zero during business hours for reception to redirect your call. If outside business hours, wait for voicemail message to indicate either a cell number to call or an on-call person.
- When completing an installation or service call, please call zed.i with customer details, programming options put into Field Instrument, signal strength and channel, serial numbers, antenna style, and available sunlight into solar panels.
- Visit www.smart-alek.com/service for software and documentation updates.

About the zedi Smart-Alek® System

Smart-Alek® is the most reliable, cost-effective, end-to-end, intelligent remote gas-monitoring solution in the industry. It generates a tangible return on investment in a very short time.

Smart-Alek replaces mechanical flowmeters and paper charts with a digital flow computer that has advanced analytical capabilities, wireless communications, and a web-based geographical interface.

Smart Alek is part of a complete end-to-end intelligent remote monitoring information system, which includes a network infrastructure, communication standards, database integration, and geographic based software applications that create a seamless business environment designed to improve the productivity of natural gas operators.

The System converts the physical parameters of pressure and temperature into digital information. The information is stored in the device and then transmitted via a public wireless service to the Network server.

Through an End-user interface, Smart-Alek® enables a customer to observe and analyze the performance of their well or pipeline on a real-time basis.

Time intervals range from typically one hour to daily data transmissions, dependent on Field Instrument configuration.

The System can also be configured to send alarms, which in turn allow operators to quickly respond to problems. Since this is a Web-enabled system, the data is available simultaneously to all those who need, and are authorized, to see it.

The basic functions carried out by the system are:

- Measure sensor values (i.e., two pressures and temperature).
- Calculate applicable averages of the measurement samples.
- Transmit the data from the Field Instrument to a central Network database.
- Provide data and calculated information to the End-user via Internet-based access.

Using the Smart-Alek System, it is possible to deliver applications and reports on pressure, flow and temperature to anyone, anywhere with access to a personal computer and an Internet connection.

It enables large scale monitoring of even the most remote assets.

Using its own IP address and communications via cellular or satellite, the Smart-Alek represents the most comprehensive, accessible system for intelligent remote monitoring available.

About the Smart-Alek V2X Field Instrument

The Smart-Alek V2X Field Instrument is a self-powered "smart" device with built-in sensors for remote field monitoring of gas meter runs. It is an eTube and orifice monitoring instrument that uses a wireless modem for communication, and is CSA/IEC-certified for Class I Div 1, Groups C & D areas, Class I, Div 2, Group C & D, Zone 0,1, 2 Group IIA, IIB.

It is a self-powered, wireless, digital gas flow meter that delivers accurate production data to the desktop in real-time.

The Field Instrument replaces mechanical flow meters and paper charts with an intelligent end-to-end digital network that instantly delivers wellsite information. The net result is reduced downtime, increased production, and increased earnings. The solution represents a significant advance from existing remote monitoring technologies.

The Smart-Alek V2X Field Instrument measures gas pressures and temperature from a differential (e.g., orifice) meter, stores the readings and securely transmits the information to the Network server via public wireless services such as cellular or satellite.

The basic Field Instrument measures Static Pressure, Differential Pressure, and Flowing Temperature. Internal instrument temperature and battery voltage are also recorded.

The Field Instrument is self-contained and can be mounted at the meter-run, at the wellhead or pipeline, inside a separator shack, or on other site structures. It is powered by a rechargeable battery pack and a 5W solar panel. Included with the instrument is the cabling needed to connect to the supplied solar panel, antenna, and RTD. The Field Instrument can be configured with a laptop PC using zedi's Smart-Alek Communicator software.

To achieve low-power operation the Field Instrument's communication link is normally powered off, and is activated under its own control. Consequently, the flow of information from the Field Instrument to the Network is governed by a data transmission schedule programmed into the Field Instrument. The interval is determined and set based on the sample averaging requirements and the communications type (digital cellular or satellite).

Features

General

- Stand-alone operation, Powered by rechargeable battery and solar panel
- Low Power, Intelligent power management
- Configurable
- Secure Wireless communications
- Multi-level security
- Self-diagnostics – power supply, communication

Flow Measurement Related

- Sensor Sampling Compliance: API Chapter 21
- Averaged values (settable from 1 minute to 1 hour maximum) sent to Network server.
- Flow Algorithms - Function provided by the Network Server
- Configurable On-site Local display
- Communications reporting period (up to once per hour for flow information)
- Alarms and reporting priorities (Ability to set call out alarming)
- Data retention: Sample Averages - Minimum 35 days on Smart-Alek Field Instrument

Field Instrument variations

The Smart-Alek has a different pressure sensor for different pressure ratings.

DP Sensor	GP Sensor
6kPa / 24"wc	500kPa / 72.5psi
6kPa / 24"wc	3MPa / 435psi
32kPa / 128"wc	500kPa / 72.5psi
32kPa / 128"wc	10MPa / 1450psi
130kPa / 520"wc	10MPa / 1450psi
130kPa / 520"wc	17MPa / 2500psi

Wireless Modem variations

Smart-Alek field Instruments use one of the following types of wireless modem:

- **Cellular** modems that communicate via a cellular tower.
- **Satellite** modems communicate via a satellite link.

Each modem type has a unique set of operating conditions, limitations, requirements, and programming instructions. The modem is initialized and tested using Smart-Alek Communicator software.

Temperature Sensor variations

There are two types of temperature sensors used: 610 and 612.

The temperature sensors can be 6 inch (adjustable), 2 $^{1}/_{2}$ inch, or 3 $^{1}/_{2}$ inch.

Model 612

Model 610

Figure 1 RTD types

Antenna variations

The Field Instrument modem uses a low-profile omnidirectional antenna.

There are two types of antennae:

- Satellite Low Profile Omnidirectional Antenna.
- Cellular Low Profile Omnidirectional Antenna

Cellular modems can also use directional UHF 'yagi-style' antennas. Please note that 'yagi-style' antennae **cannot** be used with satellite modems. For more information, contact zedi solutions.

RS485 Devices

The Field Instrument supports RS485 devices, such as the NuFlow MCIII for the applications that need fluid measurement. See Chapter 6 for more information.

About the Network & End-user Interface

The Network portion of the system collects data from a large number of remote Field Instruments, through public wireless services. The data is stored in a secure database configured to monitor and relay the information that is valuable to each individual customer.

Through a secure, web-browser-based End-user interface, a customer with appropriate permissions can choose the information delivered to them, and configure what form it is to be delivered. Basic information consists of text and graphical representations of data collected from the remote Field Instruments (i.e., pressure trending), and exception reports (i.e., alarm conditions). For selected geographical areas the End-user interface also provides a map-based view of the customer's Field Instrument sites.

Besides using a personal computer, the user can be alerted to alarm conditions through other web-enabled devices such as cellular phones and pagers. The system also permits the export of data to a number of specific software products from different application service providers.

As part of the Smart-Alek system, Smart-Alek Communicator is a software interface program that links your computer to the Smart-Alek Field Instrument. Use Smart-Alek Communicator to set up, test, operate, calibrate and perform routine maintenance on the Field Instrument.

Field Instrument External Dimensions

All dimensions are in inches. Keep 6 inches clearance on all sides.

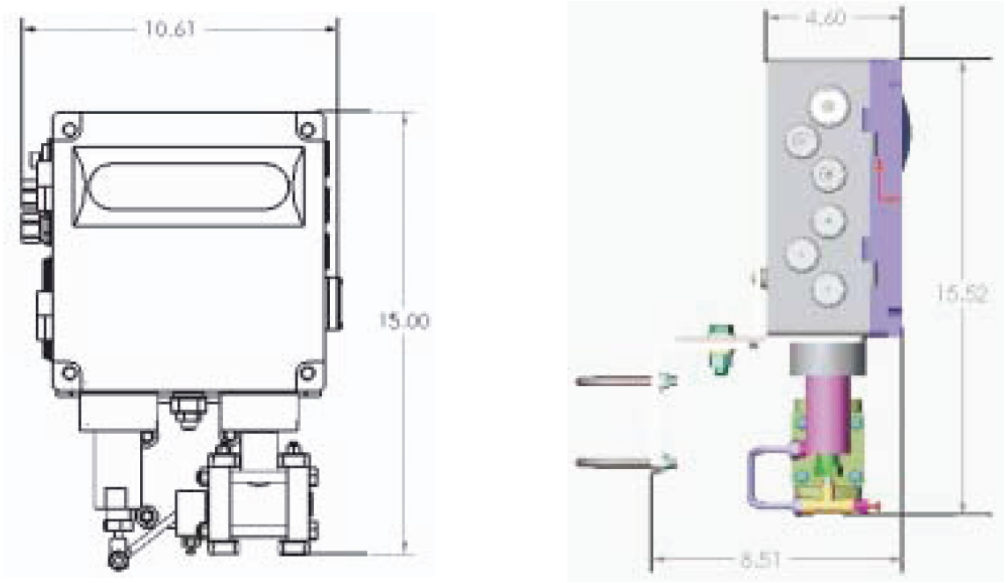


Figure 2 Field Instrument External Dimensions

General Equipment for installation

- Power Drill (AC or DC) and Drill Bit Set
- Power Generator (for AC to run power tools in truck, charge the laptop battery, accessory lighting, in case truck battery dies)
- Converter and Inverter to charge laptop batteries (if necessary) from truck battery or generator. Do not connect a vehicle inverter to a laptop that is connected to a Smart-Alek Field Instrument
- Extension cords
- Standard and Metric Wrench set
- Standard and Metric Hex Wrenches
- Adjustable wrenches (all sizes)
- Pipe Wrenches
- Shovel
- Tape measure
- Maps
- Computer with the latest version of Smart-Alek Communicator installed, and a serial port
- RS-232 Communication Cable (serial cable) for connecting laptop to the Field Instrument
- MultimeterLadders
- Flat-Head Screwdrivers
- Socket Nut or Nut Drivers
- Lineman Pliers
- Needle-Nose Pliers
- Utility Knife
- Tube Cutter
- Tube Bender
- Assorted Fittings
- Teflon tape
  Note: Do not use regular teflon tape with stainless steel - use a tape qualified for gas service as required.
- Electrostatic Discharge (ESD) Protection.
- Wire Stripper/Cutter
- Anti-Oxidant Dielectric (Superlube) Grease
- Black Electrical Tape
- Industrial Wrap and Seal Tape (rubber tape)
- Nylon Cable Ties
- Shop Rags & Water
- Leak Detection Fluid (diluted soap solution)
- Digital Deadweight Tester (pressure gauge)
- Spare lengths of Solar Extension Cable
- Handheld or vehicle phone

Safety Equipment

Use safety equipment as required. Safety equipment can include:

- Flame-retardant (or equivalent) coveralls
- Hard Hat (to CSA and ANSI standards)
- Safety Goggle/Glasses, to (Canadian Standards Association) (CSA) and ANSI standards)
- First Aid Kit
- Safety Boots
- Communication Device (if you are working alone)
- Gloves
- Gas Detector monitor (sniffer) to measure levels of hydrogen sulfide (H_2S), oxygen ($O_{2)}$ and carbon monoxide (CO)
- 5-minute Escape Pack
- Hearing Protection
- Fire Extinguisher

Parts required

Parts Required to install the solar panel

- One Solar Panel mounting bracket
- One 5-Watt Solar Panel with Mounting Yoke attached
- One $^{3}/_{8}$-inch-16 x $^{3}/_{4}$-inch Full Thread Cap Screw (Hex Bolt), Grade 5, included on the Mounting Yoke to secure the Solar Panel to the post on the solar panel mounting bracket.

Parts Required to mount the Field Instrument

- Smart-Alek Field Instrument with one two-piece Smart-Alek Mounting Bracket, that is attached to the Smart-Alek and comes with:
  - Two $^{3}/_{8}$-inch Nuts
  - Two $^{3}/_{8}$-inch Lock Washers
  - Two $^{3}/_{8}$-inch x 1-inch Bolts
- Available pipe or Smart-Alek Mounting Post
- One 2-inch x $^{3}/_{8}$-inch U-bolt (2-inch gap)
  - Two $^{3}/_{8}$-inch Nuts
  - One $^{3}/_{8}$-inch Two-Hole Rectangular Washer

Parts Required to install the temperature sensor

- An installed thermowell
- Temperature Sensor (6-inch probe or 3 $^{1}/_{2}$ -inch stem/probe)
- Teflon tape
- A set of teflon ferrules & Bore Through Fitting.

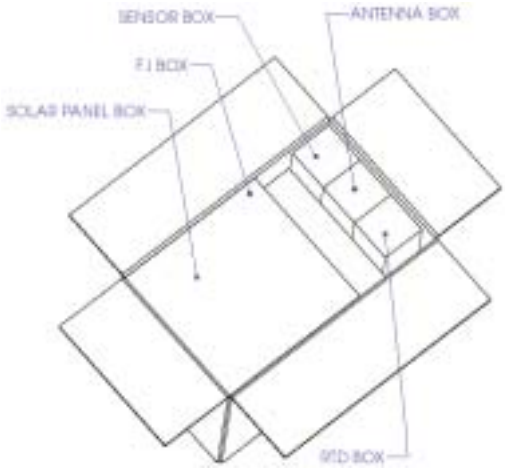
Parts Required to attach the cables

- Solar Panel with Antenna Cable (269 mm N-Plug to N-Plug RG-142 Coaxial RF Cable) attached
- RF/Power Extension Cable (TNC-to-TNC)
- Mounted Satellite Modem Enclosure (for satellite installations)
- Mounted Smart-Alek Field Instrument
- Anti-Oxidant Dielectric Grease (Superlube or equivalent)
- Weatherproof rubberized tape and electrical tape
- Cable Ties or Clamps
- Solar extension cable (when second solar panel is required)

In the Smart-Alek Installation kit

NOTE If any components are missing or are loose that are supposed to be connected to the Smart-Alek, e.g., RF/Power Cable Assembly has come loose during shipping or transportation , contact Client Services & Support. To contact us, see “Introduction” on page 2.

The Field Instrument box contains the Field Instrument, Solar Panel, Antenna, RTD, and optional RS-485 device.Serial number of the instrument. Identification on Field Instrument, Packing Slips and Work Orders must match.



A sticker on the box identifies the Field Instrument type and serial number.

The box also contains a CD-ROM with Smart-Alek Identification file (.zid file). You will need the file on this CD to program the Field Instrument.

The serial number on the CD must match the serial number on the Field Instrument.

A crossover tube is packaged separately in the box. You will have to assemble the crossover tube to the pressure cores on the Field Instrument before installing the instrument.

Antenna

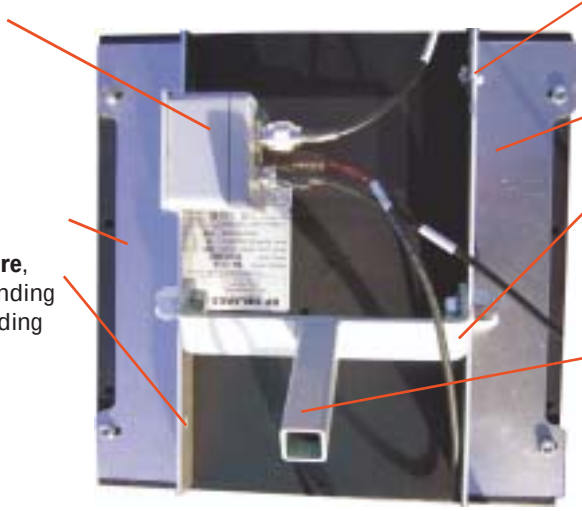
Cellular modem Field Instruments ship with a dual band antenna, with mounting bracket, attached RF cable, and grounding radials.

Figure 3 Satellite and Cellular Antennas

Solar Panel

A **Bias Tee** transfers both solar panel power and antenna signals to a single cable that attaches to the Field Instrument. The Bias Tee is used with cellular modem Field Instruments only - it isn't used with satellite units. Attached to the Bias Tee are the:
- Solar Panel Cable.
- RF Input Cable
- RF/Power Cable
.See page 26.

The **antenna** is installed here, using the supplied nut, bolt, and washer.



Right L-Bracket

Tilt the solar panel (if necessary) so it is vertical, then tighten into place.

Left L-Bracket

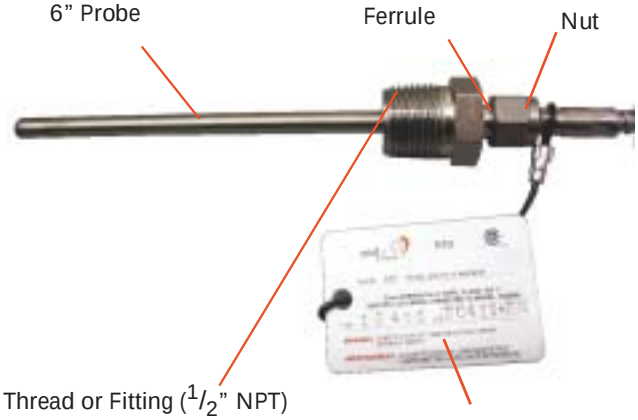
The **Ground Cable attaches here**, and is attached to a single grounding point (see "Installing the grounding cable" on page 27.). **The Field Instrument must be properly grounded before turning it on**.

Mount the **solar panel stem** to the installed post , then tighten the Thread Cap Screw $^{3}/_{8}$-inch-16 x $^{3}/_{4}$-inch Full Thread Cap Screw (Hex Bolt) in Mounting Yoke

Figure 4 5W Solar Panel Back

The front of the solar panel should face south to ensure maximum sunlight is received, and be completely vertical (in Alberta).

RTD

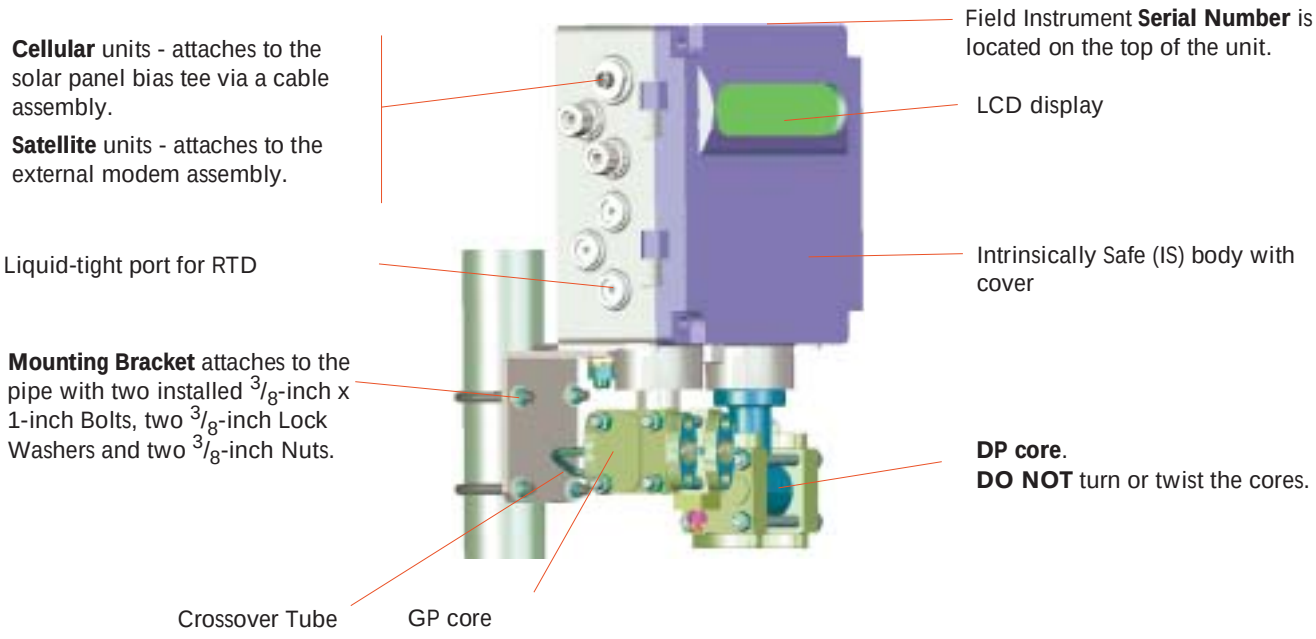


The RTD connects to the Field Instrument's I/O terminal block.

The carton for the satellite modem enclosure contains

- CID1 Satellite Modem Enclosure Assembly
- CID1 Satellite Antenna Assembly
- CID1 modem enclosure.
- Modem Interface cable.

About the Field Instrument



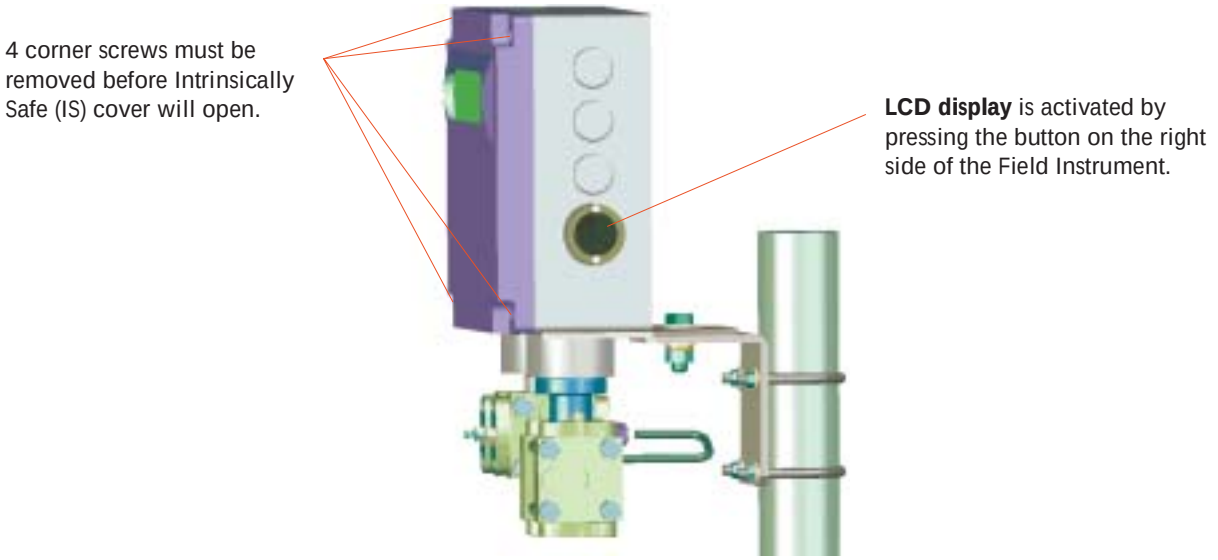


Figure 5 Smart-Alek Field Instrument

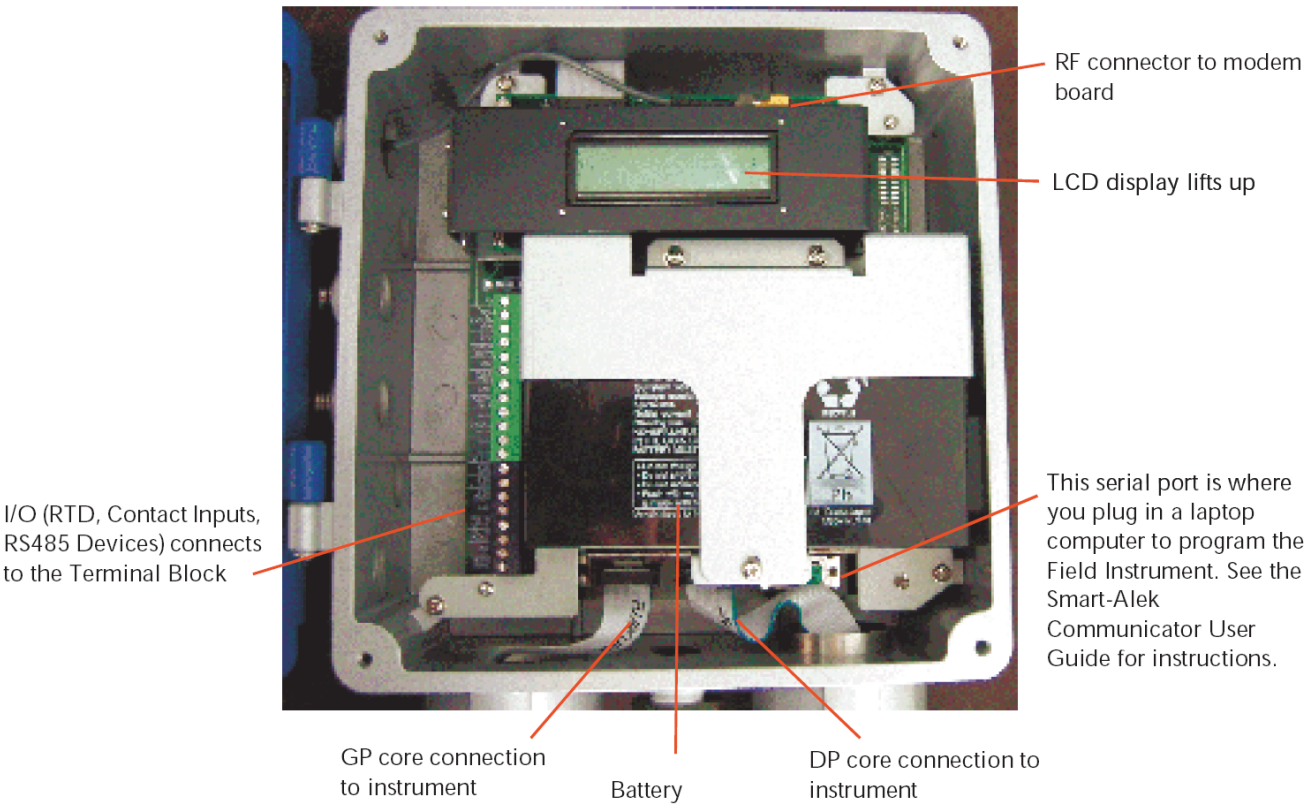


Figure 6 Smart-Alek Field Instrument with cover open

External Accessories

- PolarTek Informer+ Totalizer
- NuFlow MC III Totalizer
- Fuji Pressure Sensor
- CID1 Keller Sensor

Chapter 2

Pre-Installation

CAUTION: Static Sensitive Device(s)

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Installing the grounding cable, 23

Smart-Alek Installation in a Meter Run Shelter, 23

Before you go to the site

CAUTION

Work can be performed only in an area known to be non-hazardous. The zone must first be declassified.

NOTE

A Factory Acceptance Test was performed by the zed.i solutions Service Department before the Field Instrument left zed.i solutions.

Before you go to the site, make sure you have the following information:

- LSD (Legal Subdivision) of the site
- Site/Customer Contact Person's name and phone number
- Additional required parts (list them on the Sales Order)
- Well Static Pressure
  - Normal operating Static Pressure the Field Instrument is likely to see (optional)
  - Maximum Static Pressure the Field Instrument is likely to see (required)
- Differential Pressure (optional)
  - Normal operating Differential Pressure pressure
  - Maximum Differential Pressure the Field Instrument is likely to see.
- Is a directional, "yagi-style" antenna required? Do you have one available if troubleshooting is required?
- Is there sour gas at this site? If yes, what is the concentration?
- Is there a meter run shelter? If yes, is it a walk-in type (meter run is indoor) or a cabinet type (meter run is outdoor).
- Is there a thermowell available for the temperature sensor?
  Note: You cannot install the temperature sensor without a thermowell.

  (If there is a thermowell) what size is the thread? What is the depth?
- Pipe diameter of the meter run. (Make sure the meter run size is the same as the pipe ID.)
- Orifice plate diameter (or Beta Ratio if using eTube)
- Is the Field Instrument the only monitoring device, or will it be run in tandem with a chart recorder or other electrical monitoring device?
  - If run in tandem with a chart recorder or other electrical monitoring device, what is the type?
  - If there is an existing monitoring device, does it have a standard 5-valve manifold?
  - If not, does it have an equivalent plumbing/valve system?
- If there is an existing monitoring device with a 5-valve manifold, does the customer want:
  - The Smart-Alek Field Instrument and the existing instrument to share the 5-valve manifold?
  - The Smart-Alek Field Instrument to have its own 5-valve manifold?
    If so, there must be available taps on the meter.
- Is there a separator?

- Can the customer's Field Technician/Operator determine and approve the location of ground rods, or other approved ground point per the Electrical Code?
  If yes, has the customer's Field Technician/Operator done so for the ground point, antenna and solar panel? If no, an Underground Survey may be necessary.
  - Is the meter run on a skid?
  - If so, is the skid on pilings? Is it welded to the pilings?
  - Are there stakes at the site that show where piping is? (Location for work has already been determined and marked.)
  - Is a Ground Disturbance Report necessary? This report is based on a Ground Survey to see if there is underground electrical and piping and where they are located. Some companies require it before you are allowed to install the Field Instrument.
- Obtain any required work permits from the from the customer.
- Complete the customer's Safety Course(s) as required before you perform any work at their site. Obtain safety certifications as required for work in Hazardous, H2S and Class I Div 1 environments, and First Aid. Safety certifications are required before you perform any work at the site.
- Review and stay up-to-date on company safety policies and procedures before you perform any work at the site.
- Ensure you can get access to the site at the date and time required. Some Field Instrument locations can be inaccessible during the parts of the year.
- Are there any special concerns at the site (water, fences, locked gates, environmental restrictions, wildlife)?
- Get directions to site and arrange a meeting place to meet with customer's Field Technician/Operator who will sign-off the completed work.
- Obtain the longitude and latitude coordinates of the installation site.
- Obtain the elevation of the installation site.
- Ensure you have the equipment and and information (usually from the Smart-Alek Information Form (SAIF) to program the Field Instrument after you've installed it.

Transporting the Smart-Alek Field Instrument

Transport the Smart-Alek in its original packaging to cushion it during transport to the site and to help avoid damage. Follow the directions and precautions shown on the box (e.g., This Side Up, Fragile)

At the Site

You must determine where to install the Field Instrument, and where the best location is for the solar panel. See "Determining the required minimum height of the solar panel" on page 21.

Sometimes, sites will already have:

- A walk-in-type shelter, e.g., meter run shelter, or cabinet-type of shelter,
- A chart recorder (which records static pressure, differential pressure and temperature). Existing plumbing and instrumentation may already be in place.

Checking Gas Levels

Before you begin any work when you are at the site, check the gas concentration levels, according to company Safety Policies and Safe Work Procedures. Using your gas detector/monitor ("sniffer"), verify that the levels are at safe levels according to applicable federal, provincial and/or state regulations for:

- hydrogen sulfide (H_2S)

- oxygen (O_2)
- carbon monoxide (CO)
- explosive gasses

Performing a Site Inspection

- Ensure the site or zone is declassified.
- While wearing Personal Protective Equipment (PPE) that is appropriate to the work site, perform a Site Inspection.
- Perform the Site Awareness check.
- Confirm where the electrical and pipelines are with the customer's Field Technician/Operator.
- Check for stakes marking where the underground piping and electrical are laid.
- Is space available for the Smart-Alek to be installed? (See "Field Instrument External Dimensions" on page 5.)
- Decide the mounting location of the solar panel. (For details on what you should consider, see Mounting the Solar Panel, 26.)

Installing the Crossover Tube

Before you install the Smart-Alek, you have to install the Tubing Assembly (crossover tube) onto the two pressure cores at the bottom of the unit. The tubing assembly is included in the Smart-Alek Field Instrument box.

➢ **To install the crossover tube assembly:**

1 Remove the Vinyl Caps from the crossover tube.

Vinyl caps

2 Insert tubing with pre-swaged ferrules into the fitting body until the front ferrule seats.

3 Rotate the nut with a wrench to the previously pulled-up position, at this point a significant increase in resistance will be encountered.

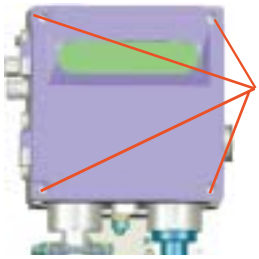
4 Tighten slightly with a wrench (approximately a quarter turn).

Installing the battery into the Field Instrument

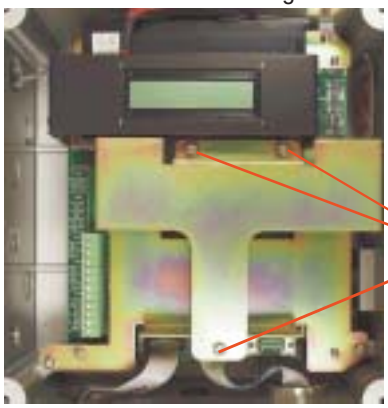
The Field Instrument is packaged with a 6V sealed lead-acid rechargeable battery pack.

To install the battery:

1 Remove the four corner screws from the Field Instrument cover, then open the cover.

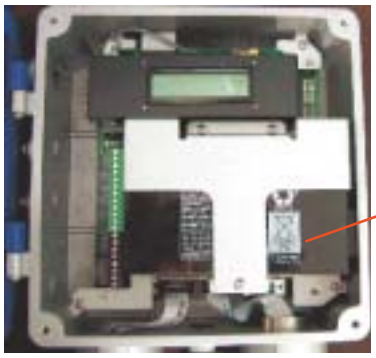


2 Remove the three holding screws from the battery bracket.

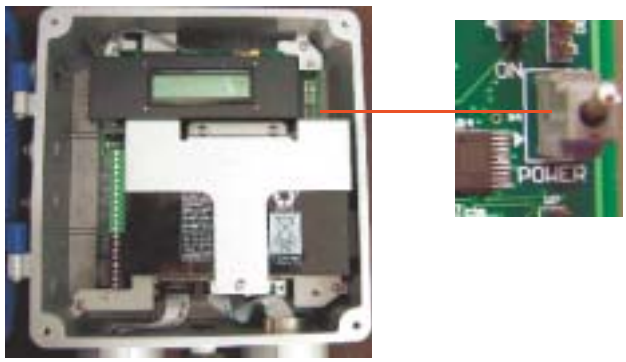


3 Insert the battery connector into the 6V BATT connector on the Field Instrument main board. The connector plugs-in at a right angle to the board.

4 Insert the battery bracket over the battery and re-insert the holding screws. Ensure the battery cables are not in the way of the standoffs, but are tucked in behind the bracket.



5 Ensure the antenna is connected, then turn the power toggle switch on the Field Instrument to ON.



6 When finished, close the cover and reinsert the front cover screws.

Pre-Installation Communication Test

CAUTION

If any components are missing or damaged, or have loosened during shipping or transportation, contact Client Services & Support at zed.i solutions. See “Introduction” on page 2.

This test checks the signal strength and quality for the modem. As you are checking this, you are also:

- determining what type of antenna mounting to use
- determining the placement of the solar panel and antenna

NOTE

Running power off the laptop batteries for this test is sufficient since it is a short test. Do not run power to the Smart-Alek through the DC-AC inverter to your laptop while communicating to the Smart-Alek or you could damage the Field Instrument.

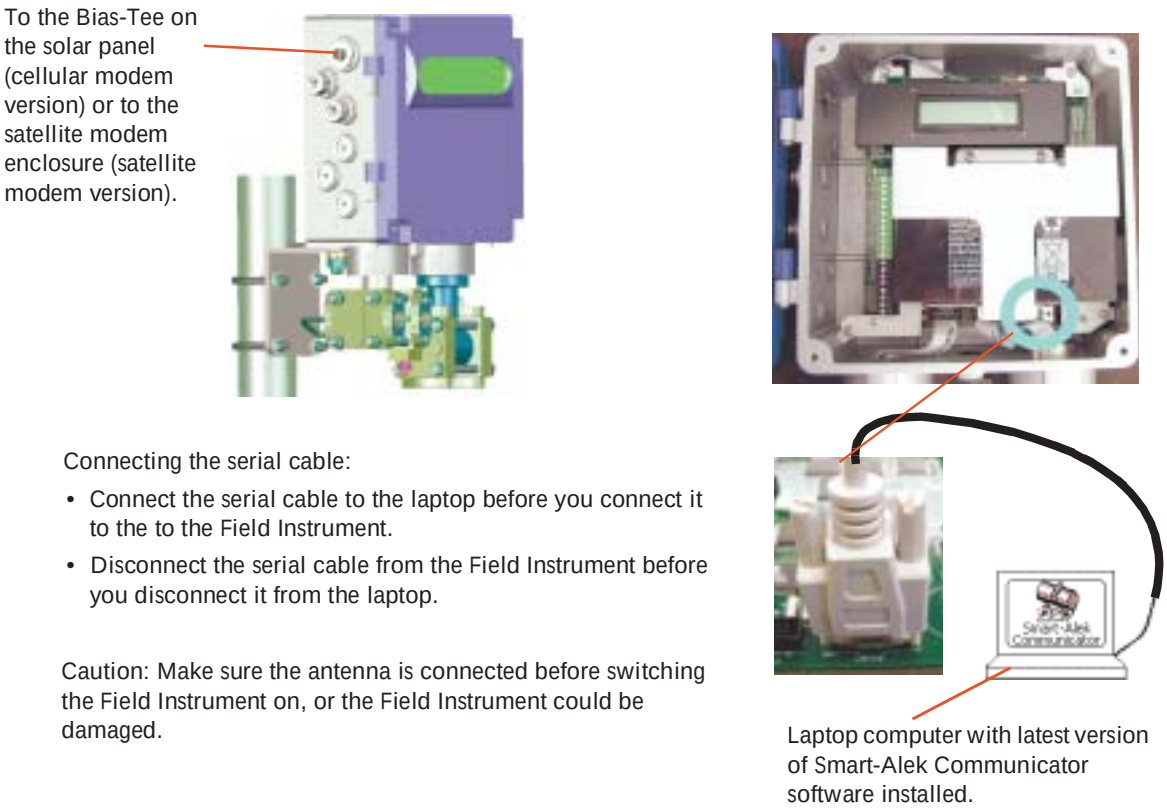


Figure 7 Pre-installation test configuration

➢ **To set up for the Pre-Installation Communication Test:**

1 If using a cellular modem, ensure the four grounding radials are installed into the low profile antenna. See “Installing Grounding Radials” on page 59.

2 Place the solar panel and antenna at a height that is similar to the height that you will be installing the antenna. Consider the clearest line of sight to a cellular tower, e.g., a truck or building is not in the path of the antenna and nearest tower.

See "Determining the required minimum height of the solar panel" on page 21.

3 Connect the antenna cable.

See "Attaching the Low Profile Antenna to the Solar Panel" on page 25.

4 Connect the RF/Power Extension Cable to the bias tee attached to the Solar Panel.

See "Connecting the Cables" on page 30.

5 Connect the laptop to the Smart-Alek.

See the Smart-Alek Communicator v2 User Guide for instructions.

Performing the Pre-Installation Communication Test

NOTE

See the Smart-Alek Communicator v2 User Guide for instructions on performing a communication test.

The Pre-Installation Communication Test identifies the best location to put the antenna for good reception by confirming:

- The radio frequency (RF) link is functional and the signal strength is good.
- The Field Instrument can lock onto a channel and receive a signal.

CAUTION

To prevent possible damage to the modem, make sure you connect the antenna before you start the Communication Test,

Only use Offline mode in Smart-Alek Communicator for the Pre-Installation Communication Test.

The communications test consists of:

- Initializing the modem
- testing the modem
- performing a Test Host procedure

See the Smart-Alek Communicator v2 User Guide for complete instructions.

Determining the required minimum height of the solar panel

Panels should receive 4hrs of direct unimpeded sunlight - preferreably around noon. Ensure that the solar panels have full sun at winter solstice. For maximum effect, the solar panels should be mounted vertically, facing directly into the sun (i.e., due south in the Northern Hemisphere), and none of the solar panel should be shaded. Based on the site layout, the minimum height of the solar panel can be calculated as follows:

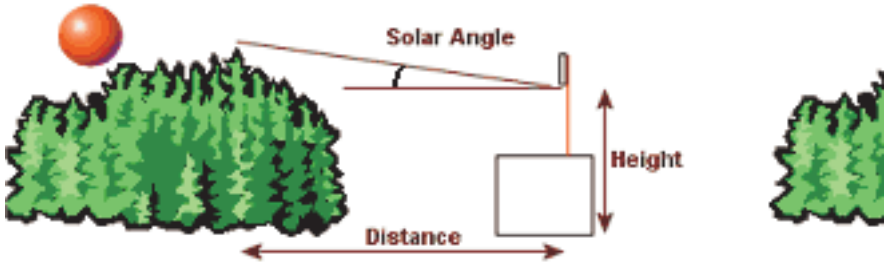


Figure 8 Calculating the minimum solar panel height.

Minimum Height of Panel = Height of Trees – (Distance x AngleFactor)
where:

Height of Panel is the distance from the ground to the bottom of the panel.

Height of Trees is the highest point for the line of sight to the sun, from SSE to SSW. Note that this is the **minimum** height that should be used, and future growth of the trees should be kept in mind.

Distance is the distance to the trees used for the maximum height.

AngleFactor is the arctangent of the Solar Angle at the lowest part of the winter solstice, based on latitude. See table below (the shaded sections provide an indication of the effect of these factors).

Examples:		Distance to trees	5 m	10 m
		Height of trees	5 m	10 m
Latitude	Solar Angle (deg)	AngleFactor	Minimum Panel Height (m)	
60	6.5	0.11	4.5	8.9
59	7.5	0.13	4.4	8.7
58	8.5	0.15	4.3	8.5
57	9.5	0.16	4.2	8.4
56	10.5	0.18	4.1	8.2
55	11.5	0.20	4.0	8.0
54	12.5	0.21	4.0	7.9
53	13.5	0.23	3.9	7.7
52	14.5	0.25	3.8	7.5
51	15.5	0.26	3.7	7.4
50	16.5	0.28	3.6	7.2
49	17.5	0.30	3.5	7.0

e.g., [5m & 5m at 56deg latitude] Panel Height = 5 – (0.18 x 5) = 4.1m

Testing the solar panel

CAUTION

Ground yourself with a wrist strap before removing covers or touching internal components.When testing voltage, be careful not to short the voltmeter leads.

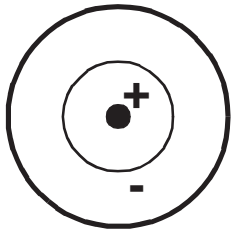
➢ **To test the solar panel:**

1 Ensure the Field Instrument is in Offline Mode.

2 Disconnect the coaxial power/RF cable from the solar panel at the point it attaches to the Field Instrument or satellite modem enclosure.

3 Place the positive lead for the multi-meter on the cable's center pin.

4 Place the negative lead on the outside of the cable's RF connector.



+ on center pin

- on inner ring and outer thread ring

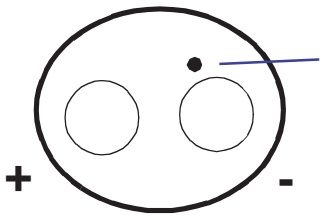
Figure 9 RF/Power connector

The voltage should be a minimum of 20 VDC and as high as 25 VDC in direct sunlight. at noon.

The voltage should be a minimum of 18 VDC and as high as 25 VDC in cloudy weather.

If a no voltage or low voltage is displayed:

- Perform a continuity check on the coaxial power/RF cable.
- The solar panel may have to be replaced You can also test the power output from the solar panel directly, using your multimeter on the cable that leads out of the panel to the Bias Tee (for cellular Field Instruments) or the External Modem Enclosure (for satellite Field Instruments).



A **dimple** on the end of the connector from the back of the solar panel denotes **negative**

Figure 10 Solar Panel connector

NOTE

If the battery's voltage drops below its rating (e.g., if a 6 volt battery drops to 5.7 volts or if an 8 volt drops to 7.7) the Field Instrument will stop communicating with the server (to save power) but will continue to record readings until the battery dies.

If you see a negative voltage:

The wrong leads from your multimeter are on the center pin and outside housing, or some connection further up the line is reversed. Ensure the connector on the two-wire power cable from the back of the solar panel into the bias tee (chrome device bolted to the back of the panel) is not on backwards.

5 If voltage is within tolerance, reconnect the coaxial power/RF cable to the Field Instrument.

Installing the grounding cable

Grounding is per national electrical code and applicable local regulations.

Current guidelines may include:

- A K-6/ LA6 lug with star washers on the frame of the solar panel
- #6 AWG stranded cable (e.g., green RW-90) from the panel to the grounding point
  Cable should be restrained with rubberized p-clips screwed to wall, cable tie downs, or tie wraps to prevent wind whipping, to keep the cable from being a hazard, and for general esthetics. (18" max between clips recommended)
- Grounding point can be one of the following:
  - 10 foot x ¾ inch steel galvanized ground rod with bronze cable clamp buried under ground. Rod is usually straight down, and requires some knowledge of underground facilities (usually means a site disturbance report)
  - A K-6/LA6 lug with star washers bolted to the frame of the structure or piling, If the structure is supported by bare steel pilings driven into the ground that can provide an electrical path to ground.
  - An existing ground system of ground rods and cabling that is already in place, that be verified visually to be intact and providing an electrical path to ground (usually found in larger structures or plant sites).

Figure 11
Connectors on the Bias Tee.

Any masts or steel / aluminum structure that elevate antennas or solar panels must also be grounded in a similar way as the solar panel.

External Sensors are intrinsically safe and operate on an RS-485 modbus system, grounds/ shields are not usually required to be connected on external cabling, unless needed for noise reduction.

NOTE (Note: To prevent ground loops, shields should be connected at only one end.)

Smart-Alek Installation in a Meter Run Shelter

Often, there is a meter run shelter or cabinet that protects the instruments on a meter run.

The physical hook-up has two parts, with one **inside** of the meter run shelter and one **outside** of the meter run shelter.

- **Inside** of the meter run shelter: Installing the Smart-Alek, 5-valve manifold, tubing, tees, temperature sensor, etc.
- **Outside** of the meter run shelter: Installing the solar panel and antenna, ground cable, ground rods, etc.

Considerations when installing the Field Instrument in a Meter Run Shelter

- (In the Northern Hemisphere, mount the solar panel and antenna on the south side of meter run shelter.
- Mount the solar panel Side-Mount Bracket as close to the top of the meter run shelter as possible.

Figure 12
Solar Panel - Side Mount on side of shelter dacing direct sunlight. Note: Ensure the antenna is mounted above the roof of the enclosure.

1. Drill a hole (usually 1 $^{1}/_{8}$-inch) in the wall of the meter run shelter close where the Field Instrument will be installed.
2. Insert the plastic or metal conduit as required to meet CLASS I DIV 1 Hazardous Locations' Standards.
3. Run the RF/Power Extension Cable and insulated ground cable through the conduit in the hole.
4. Fill and seal the hole drilled into the wall of the meter run shelter for the RF/Power cable to meet CLASS I DIV 1 Hazardous Locations' Standards using 1 lb. Pug Duct Seal (Electrical Putty to seal hole for CLASS I DIV 1 inside the meter run shelter) (Note: Outside the shelter is CLASS I DIV 2.)

   See "ANSI/ISA-RP12.06.01-2003."

Chapter 3

Installing a Cellular Field Instrument

CAUTION: Static Sensitive Device(s)

Contains components susceptible to damage from Electrostatic Discharge. Handle only using static preventive processes.

Attaching the Low Profile Antenna to the Solar Panel, 25

Mounting the Solar Panel, 26

Attaching the Field Instrument, 28

Installing the Temperature Sensor, 29

Connecting the Cables, 30

Attaching the Low Profile Antenna to the Solar Panel

➢ **To attach the low profile antenna onto the solar panel:**

1 Remove the nut, bolt and washer from the right L-bracket attached to the solar panel.

2 Place the antenna mounting bracket against the right L-bracket attached to the solar panel.

3 With the bolt head on the outside of the solar panel, re-insert the ¼-inch-20 x ½-inch bolt through:

- the hole in the antenna mounting bracket, that is furthest away from the edge
- the ¼-inch star washer
- the right L-bracket on the solar panel

- the ¼-inch-20 hex nut

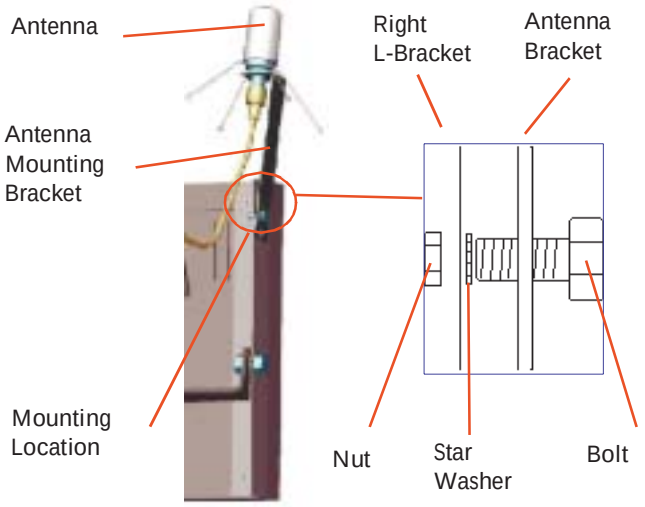


Figure 13 Low Profile Antenna Placed Against Solar Panel

➢ **To connect the cable between the antenna and bias tee on solar panel:**

1 Apply anti-oxidant dielectric (Superlube) grease to the threads of the N-Plugs on the antenna cable. DO NOT get grease inside the cable.

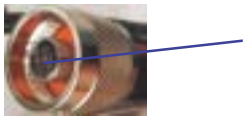


Figure 14 RF cable connector

2 Connect the N-Plug on the antenna cable to the N-Plug on the bottom of the low profile antenna, if it is not already. Hand tighten the connector. DO NOT use a wrench or pliers to tighten.

3 Connect the N-Plug on the other end of the antenna cable to the N-Plug on the bias tee attached to the solar panel. Hand tighten the connector. DO NOT use a wrench or pliers to tighten.

4 Tape the connection tightly from up against the bulkhead to the wire and back with weatherproof rubberized tape.

5 Tape the connection from up against the bulkhead to the wire and back twice tightly with electrical tape.

6 Add a wrap of electrical tape around both connectors as added support.

Mounting the Solar Panel

➢ **To mount the solar panel:**

1 Install the solar panel mounting bracket :

- to the pipe (using the supplied pipe mount bracket and u-bolts) or
- to the wall of the enclosure using the wall mount bracket (not supplied with the basic kit) on struts and metal tek screws

2 Mount the solar panel, by placing the stem of the solar panel mounting yoke on the solar panel mounting bracket post.

3 Turn the solar panel so it faces due south (in the northern hemisphere).

4 Position the solar panel to ensure it is perpendicular to the ground (i.e., facing straight up and down).

5 Snugly tighten the nuts and bolts on the solar panel mounting yoke.

6 Tighten the full thread cap screw on the stem of the solar panel mounting yoke and two side bolts.

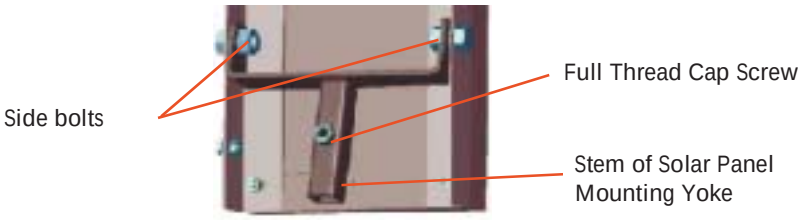


Figure 15 Attaching solar panel mounting yoke to mounting post.

7 Tighten the nut against the Right L-Bracket, star washer, antenna bracket and bolt holding the antenna bracket, so it is snug against the solar panel.

Figure 16
Nut and Bolt on Antenna Bracket

8 Crimp a cable lug or K6 connector around one end of the insulated ground cable.

The other end is attached to the grounding point.

9 Remove the $^{1}/_{4}$-inch bolt, spring lock washer, and nut attached to the Left L-Bracket on the solar panel.

10 Insert the bolt through the cable lug, spring lock washer, Left L-Bracket and nut to attach the cable lug to the solar panel.

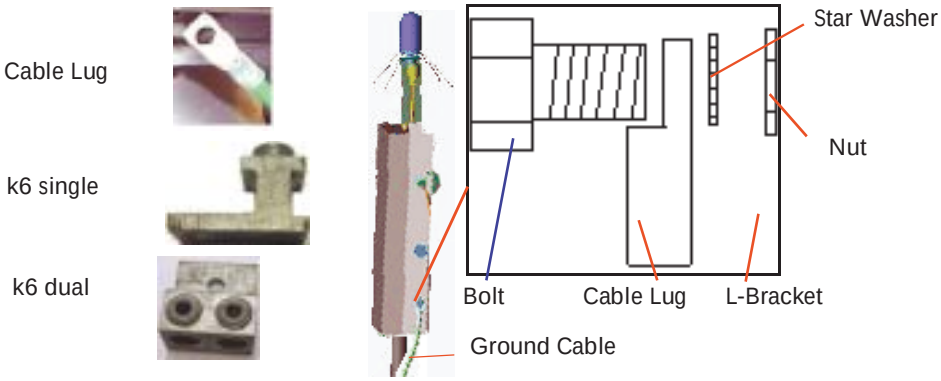


Figure 17 Cable Lug and Ground Cable Attached to Solar Panel

Attaching the Field Instrument

CAUTION

Do not turn the sensor cores.

Use only the mounting bracket to change the mounting position.

This section describes the steps to safely install the physical components for a **basic installation** of the Field Instrument:

➢ **To attach the Field Instrument:**

1 Secure the Smart-Alek to the pipe or mounting post using the two-piece mounting bracket and two U-bolts that come with the Smart-Alek

You can also mount the bracket first, then attach the Field Instrument to the bracket.

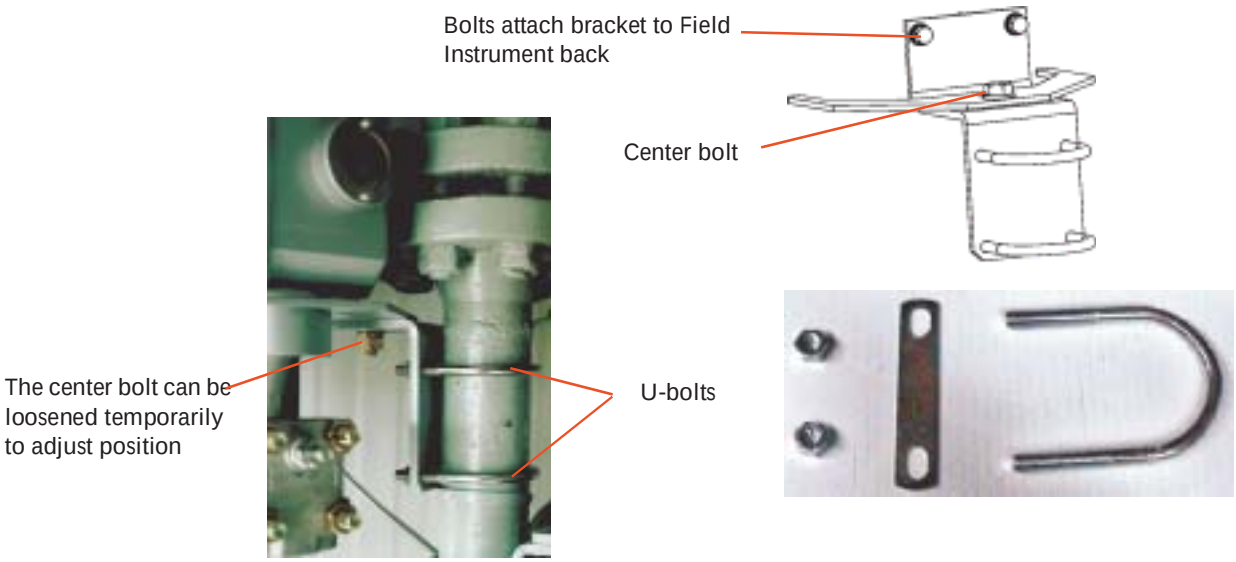


Figure 18 Field Instrument mounted to pipe with U-bolts

How you orient the Smart-Alek and Mounting Bracket will depend on space limitations at the specific site. Keep these considerations in mind:

- You must mount the Smart-Alek above the orifice meter, to prevent fluid/moisture traps (e.g., water, oil, gas), that can plug the line, altering pressure and causing inaccurate readings.
- The Field Instrument must be vertically straight and not angled or offset to one side more than the other.
- Allow clearance at the front to open the Field Instrument's front cover.
- The center bolt can be loosened to adjust position.

Installing the Temperature Sensor

CAUTION

The following installation must only be performed by qualified technicians.

The temperature sensor is usually installed in an existing thermowell on the downstream side on the meter run. The temperature sensor never has pressure applied to it and is permanently installed.

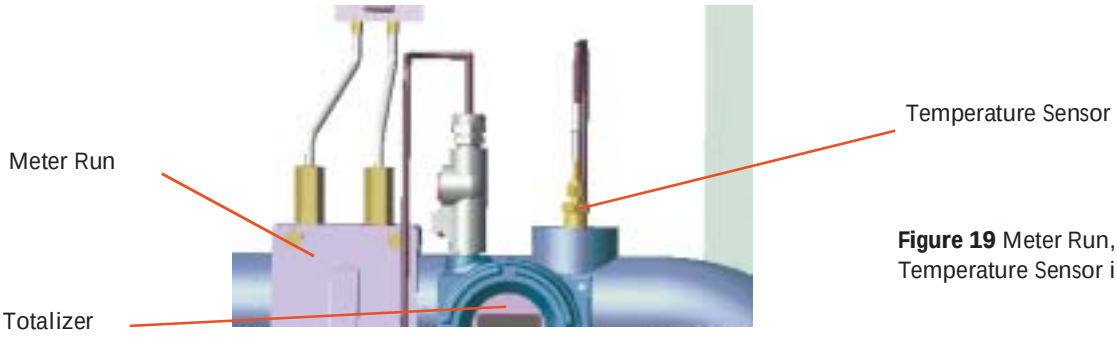
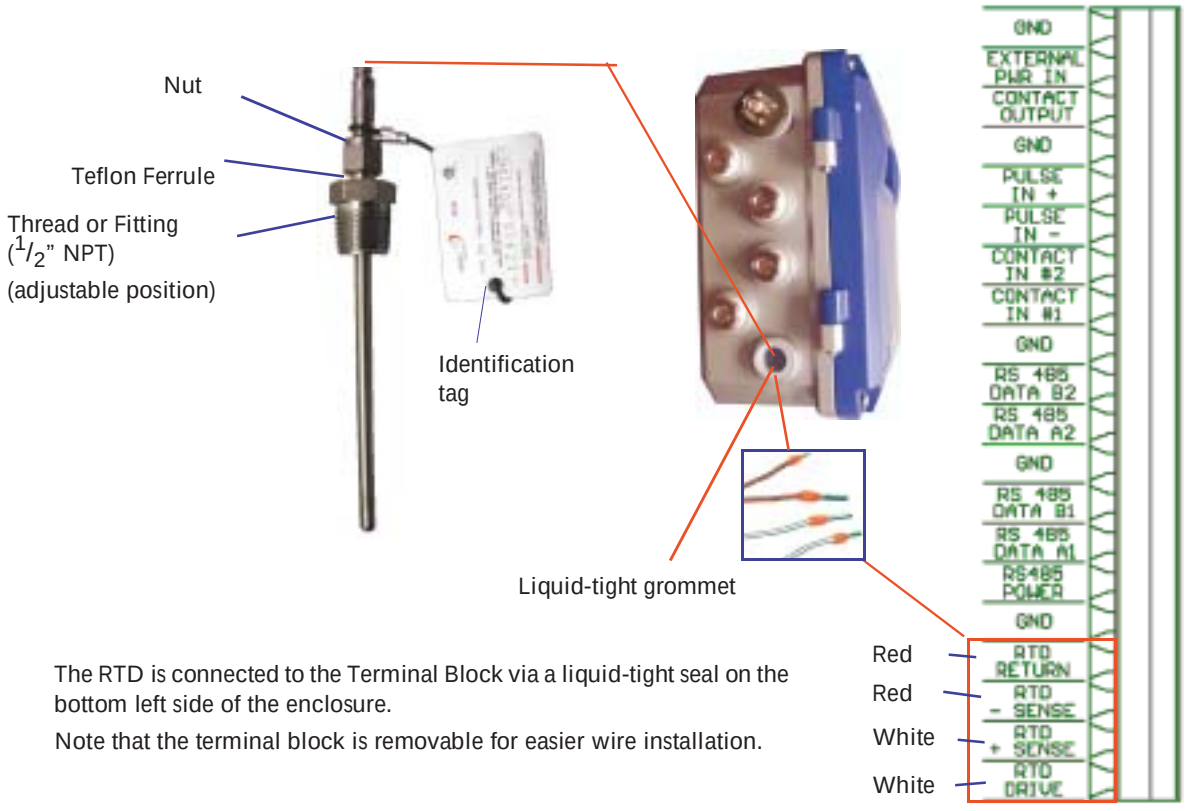


Figure 19 Meter Run, Totalizer, and Temperature Sensor in Thermowell

NOTE When there is a mismatch on the size of the Bore Through Fitting and thermowell, an adaptor will be required.

NOTE

- Install the temperature sensor in a thermowell for the most accurate gas measurement readings that are not affected by temperature changes or ambient conditions.
- The thermowell must be installed by the customer before you install the temperature sensor.



The RTD is connected to the Terminal Block via a liquid-tight seal on the bottom left side of the enclosure.

Note that the terminal block is removable for easier wire installation.

Figure 20 Temperature Sensor

➢ **To install the temperature sensor in a thermowell:**

1 Ensure the condition of the thermowell is appropriate for temperature sensor installation.

- Remove (unscrew) the plug from the thermowell.

2 Apply Teflon tape to the threads of the Bore Through Fitting.

3 Tighten the bore through fitting into the thermowell.

CAUTION

Make sure you do not overtighten or you can damage the probe part of the temperature sensor.

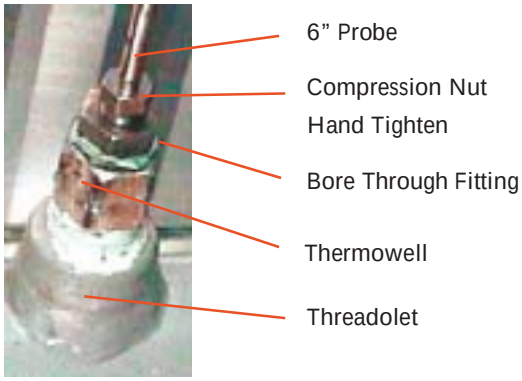


Figure 21 Temperature Sensor in Thermowell

4 Insert the probe into the thermowell.

Make sure you fully insert the probe part of the temperature sensor into the thermowell of the meter run, making sure that the end of the probe is touching the bottom of the thermowell.

CAUTION

Contact between the bottom of the probe and the bottom of the thermowell is essential for accurate readings. Be careful not to force the probe into the thermowell or overtighten the compression nut, as it can damage the RTD.

5 Hand-tighten the nut into the bore through fitting, but make sure you do not overtighten or you can damage the probe part of the sensor.

Connecting the Cables

➢ **Connecting the RF/Power Extension Cable**

1 Apply anti-oxidant dielectric (Superlube) grease to the TNC ends on the RF/Power Extension Cable. Do not let any grease get into the connector.

2 Connect one of the TNC ends of the RF/Power Extension Cable to the TNC connection on the bias tee.

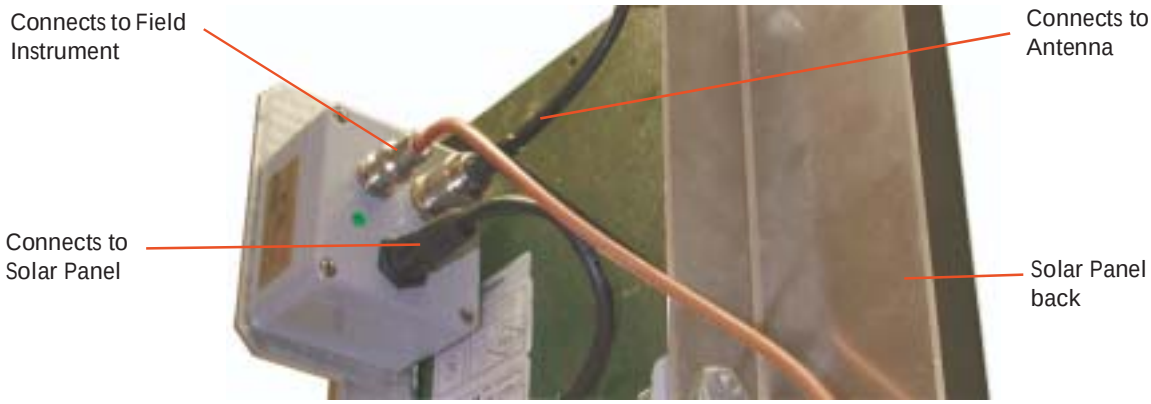


Figure 22 Bias Tee on Solar Panel (applies to cellular Field Instruments only).

3 Apply anti-oxidant dielectric (Superlube) grease to the threads of the TNC connection on the left side of the Field Instrument. The grease should only be applied to the outside threads. Do not let any grease get into the connector.

4 Connect the other TNC end of the RF/Power Extension Cable to the TNC connection on the left side of the Field Instrument.

5 Tape the connections with weatherproof rubberized tape as well as electrical tape if outside or exposed to wet conditions.

Securing the Cables

- Secure the cables as per the local Electrical Code (e.g., every 18 inches or less) to the Field Instrument or available pipes or posts with cable ties or clamps.

Figure 23 Cable clamp

- Ensure there is no strain at the connection points of the cables.
- Ensure the cables are not a tripping or hanging hazard
- Keep cables away from:
  - moving parts (e.g., methanol pumps)
  - sources of cold (e.g., areas where frost builds up)
  - sources of heat (e.g., heaters)
  - electrical cables from other system

Chapter 4

Installing a Satellite Field Instrument

Attaching the Field Instrument, 34

Mounting the Class I Div 1 Satellite Modem Enclosure, 34

Installing the battery, 36

Connecting the Cables, 36

Securing the Cables, 37

CAUTION: Static Sensitive Device(s)

Contains components susceptible to damage from Electrostatic Discharge. Handle only using static preventive processes.

CAUTION

WARNING: Only work in a location known to be non-hazardous, i.e., by declassifying the zone.

Attaching the Field Instrument

➢ **To attach the Field Instrument:**

1 Secure the Field Instrument to the pipe or mounting post using the two-piece mounting bracket and two U-bolts that come with the Field Instrument. The physical attachment is the same as for a cellular Field Instrument. See Attaching the Field Instrument on page 28.

Mounting the Class I Div 1 Satellite Modem Enclosure

Prior to installation in a suitable location, measure the distance between the Smart-Alek and the proposed location for the Satellite Modem Enclosure. Measure the distance between the proposed location of the Satellite Modem Enclosure, the Solar Panel(s) and External Battery if there is one. Choose a suitable mounting location for the Satellite Modem Enclosure based on your measurements (all the cables must reach).

The Satellite Modem Enclosure is certified for use in a Class I, Division 1 area, and is mounted on the interior of the shack wall or strut. The supplied length of conduit is used to pass the solar and RF cable through the wall of the shack. Bring spare lengths of Solar Extension Cable to the site, in case they are needed.

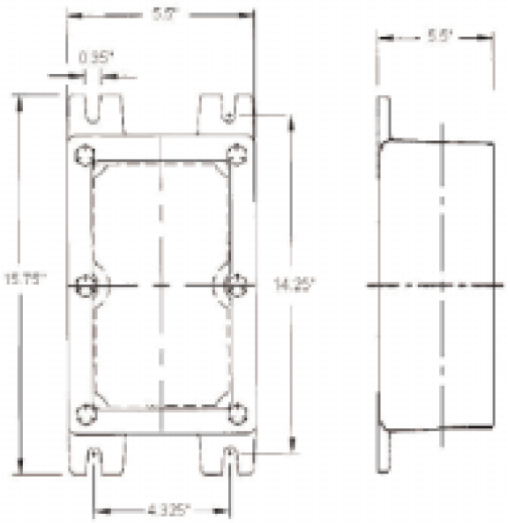


Figure 24 CID1 Satellite Modem Enclosure

The RF & solar cables must feed through the supplied length of conduit and pass through the shack wall to the outside (Division 2 zone). Note that a sealing fitting is already installed on the Satellite Modem Enclosure. The supplied length of conduit attaches to the sealing fitting & elbow. A hole must be drilled in the shack wall to accommodate the conduit.

NOTE

Alternatively, the Satellite Modem Enclosure may be installed anywhere within a Class I Div 1 area as long as conduit is used to route the RF & solar cables (the RF & solar cables are not intrinsically safe and so they MUST be run through conduit while they are in a Division 1 area). They do not have to pass through conduit once they are in the Division 2 area.

Mount the Satellite Modem Enclosure using "superstrut" or equivalent to distribute the weight of the enclosure over a wide area.

Wiring

1. The Output of the Solar Panel connects to the solar input of the Satellite Modem Enclosure via a 20ft or 30ft Solar Cable.

   Optional lengths of solar cable are available.

2. Connect the antenna to the antenna input of the Satellite Modem Enclosure via a RF cable.

   Use the supplied Superlube grease on the RF connectors to ensure a moisture proof seal.

3. Seal the end of the conduit with the supplied duct seal.

   This prevents moisture from entering the conduit.

4. Wrap both ends the solar and RF connectors with weatherproof rubberized tape and electrical tape.

5. Connect the Satellite Modem Enclosure to the Smart-Alek via an RS232 I/O Cable.

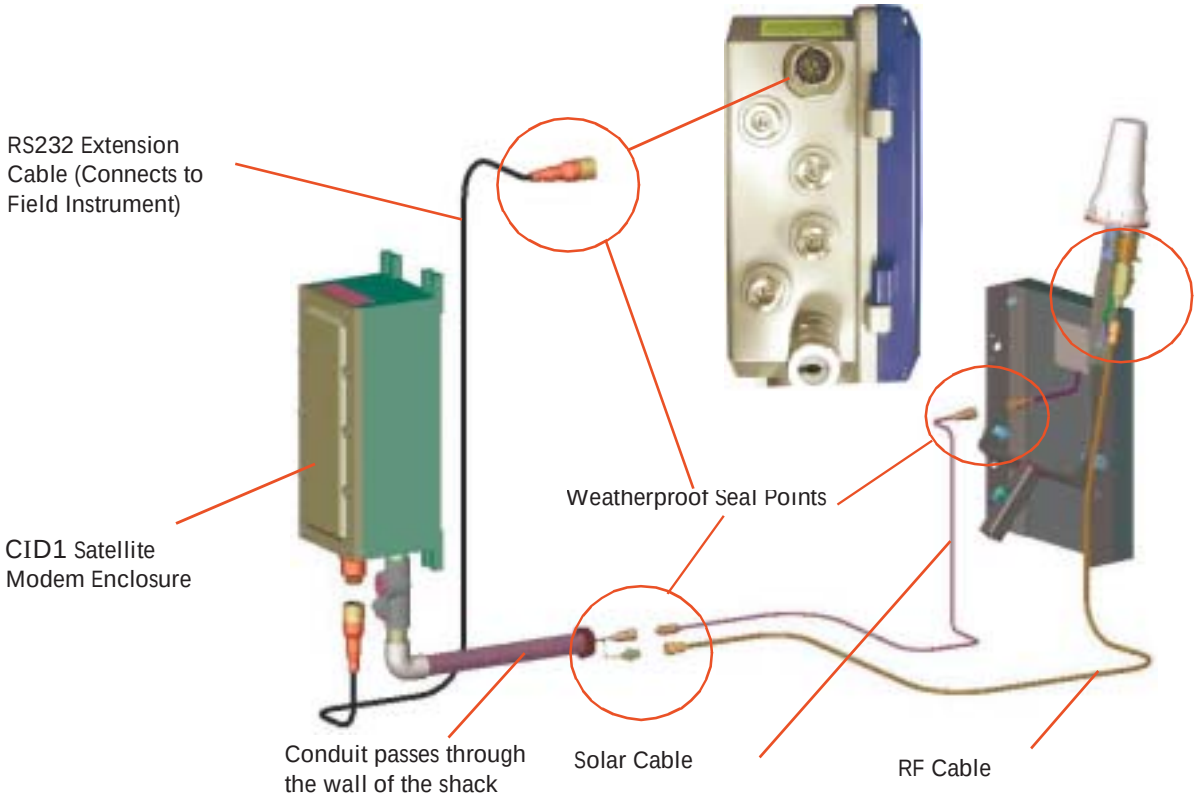


Figure 25 CID1 Satellite Modem Enclosure with Single Solar Panel

Installing the battery

NOTE Test the battery before installing it.

1. Unscrew the 10 cover bolts and remove the cover from the Satellite Modem Enclosure.
2. Install a fresh battery in the Satellite Modem Enclosure.
3. Secure the battery with cable ties.
4. Ensure the antenna is connected.
5. Turn ON the power switch inside the Satellite Modem Enclosure.
6. Re-install the cover and the 10 cover bolts on the Enclosure.
   Torque the bolts in a crisscross pattern to avoid warping the enclosure sealing surface.
   Torque bolts to 174in-lb. (14.5ft-lb. or 19.7N-m).

Connecting the Cables

One of the last steps to completing installation is connecting the Field Instrument to the solar panel and temperature sensor.

Power to the Field Instrument comes from the battery pack, which is continuously recharged by the 5 Watt solar panel, as the panel collects sunlight and converts it to power.

The RF/Power Extension Cable connects the Field Instrument to the solar panel.

Temperature is measured by the RTD in the thermowell, which is attached to the I/O Extension Cable (temperature sensor cable), which in turn, connects the Field Instrument to the temperature sensor.

1. Apply anti-oxidant dielectric (Superlube) grease to the threads of the TNC ends on the RF Cable. Do not get grease inside the center pin.
2. Connect one of the TNC ends of the RF Cable to the TNC connection on the surge arrestor that is on the outside of the L-Bracket on the solar panel.

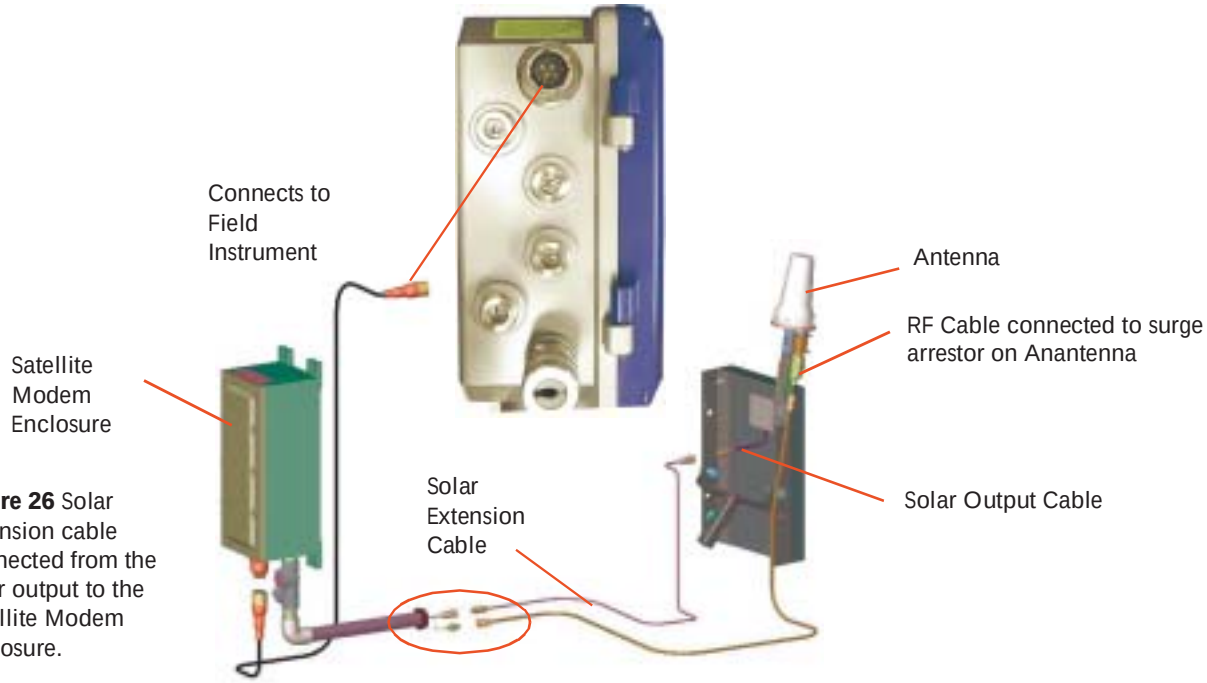


Figure 26 Solar extension cable connected from the solar output to the Satellite Modem Enclosure.

Figure 26 Cableconnections

3 Connect the other TNC end of the RF Cable to the TNC connection on the Satellite Modem Enclosure that comes out from the conduit.

4 Tape all exterior connections with Industrial Wrap & Seal Tape and electrical tape.

5 Connect one end of the Solar Extension Cable to the output connection on the solar panel.

NOTE

The power connectors are polarity sensitive. To make the connections:

- Set to first notch
- Partially twist the connectors
- Lock over the locking bump on ring

6 Connect the other end of the Solar Extension Cable to the output connection on the Satellite Modem Enclosure that comes out from the conduit.

7 Tape connectors with Industrial Wrap & Seal Tape and electrical tape.

8 Connect one end of the RS232 Extension Cable to the COMM connector on the left side of the Smart-Alek.

9 Connect the other end of the RS232 Extension Cable to the COMM connector on the Satellite Modem Enclosure.

10 Tape the connections using Industrial Wrap & Seal Tape and electrical tape.

Securing the Cables

Secure the cables:

- **As per the Electrical Code** (e.g., every **18 inches** or less) to the Smart-Alek, or available pipes or posts, etc., with **cable ties** or **clamps**, to make sure there is no strain at the connection points of the cables
- Away from any moving parts (e.g., methanol pumps)
- Away from any sources of heat (e.g., heaters)
- Away from any sources of cold (e.g., areas where frost builds up)
- Away from other electrical systems
- So the cables are not a tripping or hanging hazard

Chapter 5

Completing the Installation

CAUTION: Static Sensitive Device(s)

Contains components susceptible to damage from Electrostatic Discharge. Handle only using static preventive processes.

Installing the Tubing Lines, 40

Reapplying Pressure After Installation, 42

Configuring the Field Instrument, 46

Verifying Field Instrument LCD and Readings, 46

Before you leave the site, 47

Installing the Tubing Lines

The Field Instrument gets its Static Pressure reading from the HP port of the dual pressure sensor and its Differential Pressure reading from the difference between the HP and LP ports.

CAUTION

Flowing meter runs or pipelines must be isolated and depressurized prior to installing thermowells or isolation valves on instrumentation ports.

.

NOTE The Smart-Alek must be installed with some method of isolating it from pressurized meter runs or pipelines. This is required for making any changes to tubing lines, and calibrations of the unit.

Use only full port valves. The use of full port valves means that the inner diameter of the valve and tubing will match, therefore no restrictions in the transfer of pressure to the pressure transmitters on the SA. Valve restrictions have been known to cause erroneous readings, which translates into incorrect flow rate values.

NOTE Gauge lines installations should slope downward toward the primary meter at a minimum of one inch per foot. The length of gauge lines should be minimized as much as possible, while still allowing for the necessary downwards sloping (at least 1 inch per foot). Gauge lines should also be of uniform internal diameter and constructed of material compatible with the fluid being measured. Gauge lines shall be supported sufficiently to prevent any observable sag and vibration.

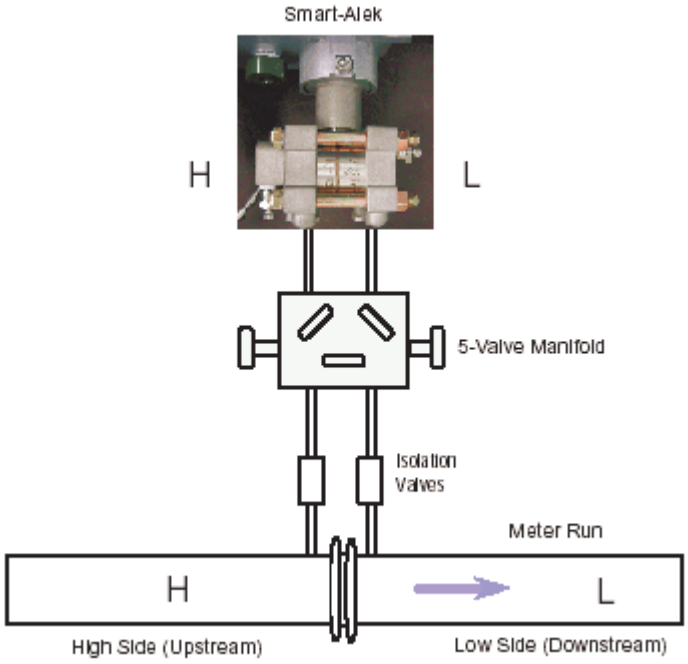


Figure 27 Installed Field Instrument Tubing

The Smart-Alek Field Instrument is installed as a stand alone unit with its own isolation valves and 5-valve manifold.

➢ **To install the tubing:**

1 Install isolation valves for each of the meter run ports (high side / low side).

Figure 28 Isolation valve

2 Install a 5-valve manifold between the isolation valves and the Smart-Alek Field Instrument.

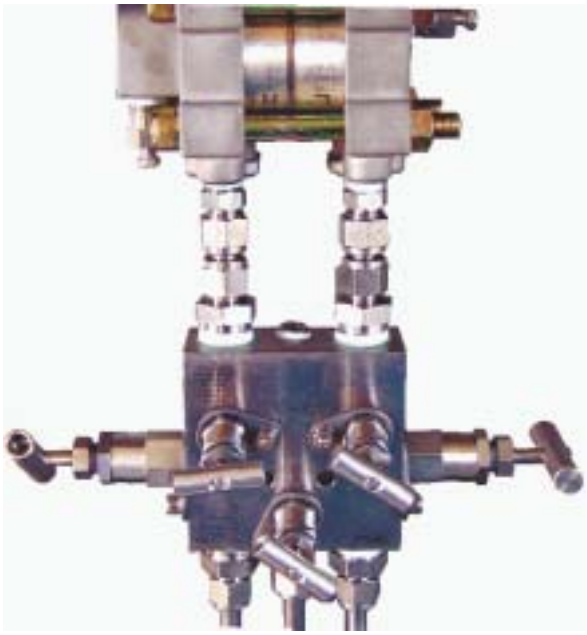


Figure 29 5-valve manifold

3 Connect the High Side port on the meter run to the Smart-Alek connection labelled H.

4 Connect the Low Side port on the meter run to the Smart-Alek connection labelled L.

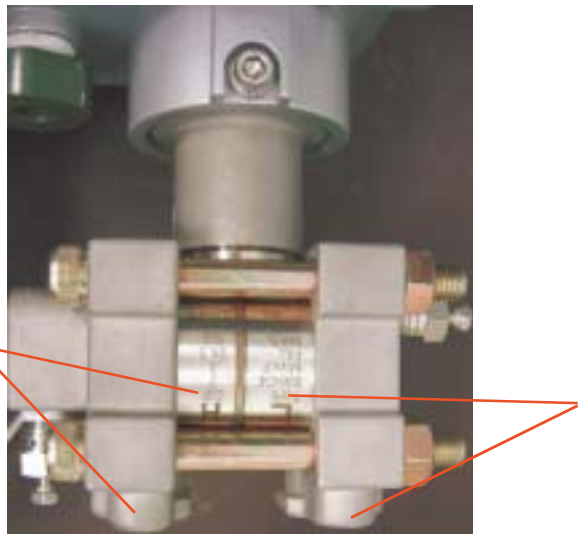


Figure 30 Differential Pressure sensor

5 Apply tape around the fittings you are inserting into the pressure ports of the 5-valve manifold.

NOTE

Regular teflon is not recommended for stainless steel. You may be required to use a tape qualified for gas service.

All tubing and valves should be oriented in a downhill slope from the Smart-Alek back to the orifice ports on the meter run. This will help to prevent fluid traps and drain off any liquids that attempt to move up the tubing lines. Lines should slope downward toward the primary meter at a minimum of one inch per foot.

The Smart-Alek is equipped with $^{3}/_{8}$-inch fittings from the factory. Existing tubing and fittings, plus any additional plumbing may be replaced with $^{1}/_{2}$-inch tubing and fittings as required.

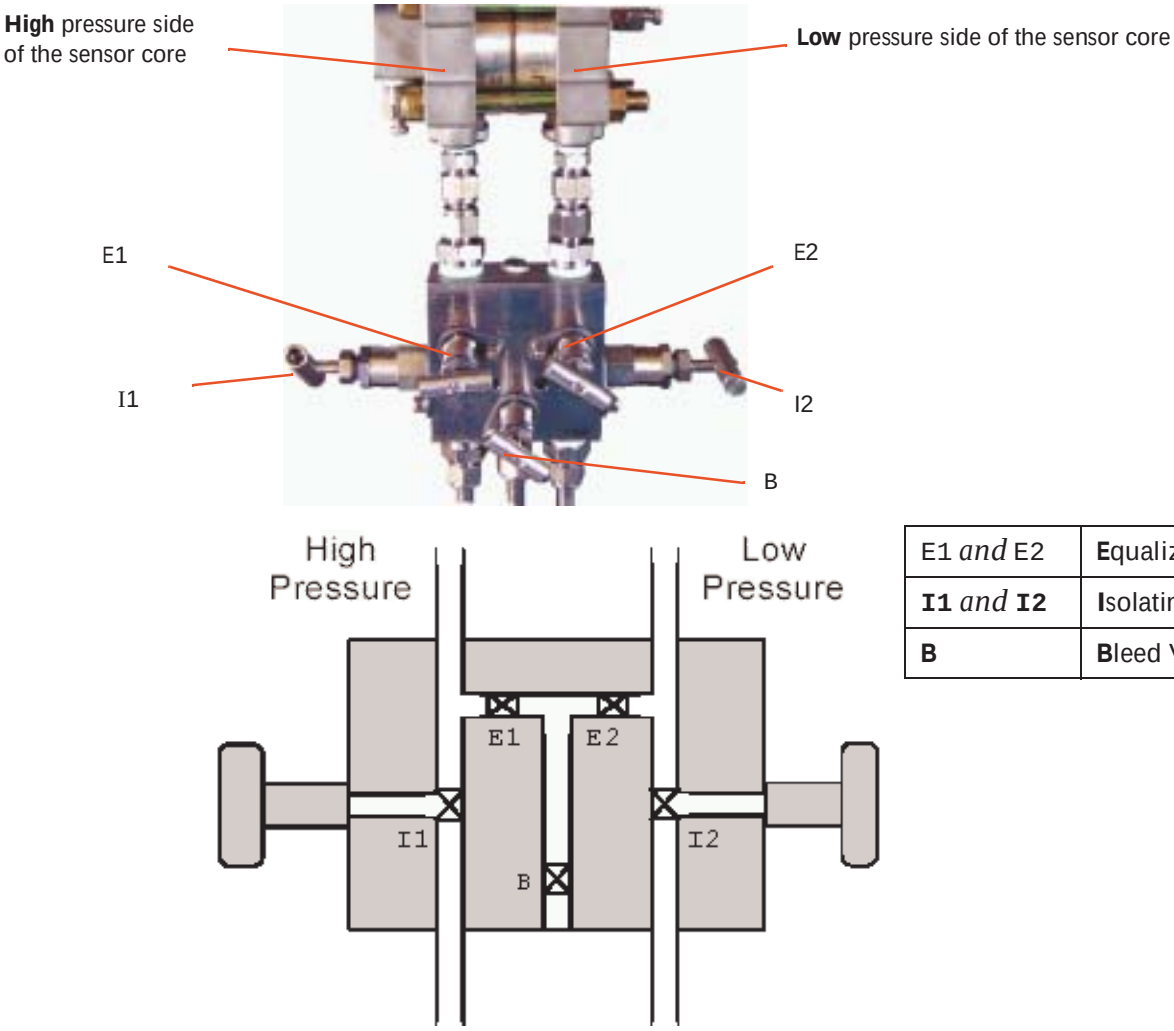
Reapplying Pressure After Installation

CAUTION

In the diagrams below, note which side is high pressure and which is low pressure.

To reapply pressure and bring the process flow back online after installation, you need to make sure you **equalize pressure** to the 5-valve manifold and dual pressure sensor properly.

Make sure you do this **before** you apply well pressure (full pressure, maximum line pressure) to the 5-valve manifold and the dual pressure sensor.



E1 *and* E2	**E**qualizing Valves
I1 *and* **I2**	**I**solating Valves
B	**B**leed Valve

Figure 31 5-valve manifold

CAUTION

Pressurizing the Field Instrument after installation **very slowly** and **evenly**.

➢ **To reapply pressure after installation:**

1 Close I1 and I2 (the isolating valves) to isolate flow within the 5-valve manifold.

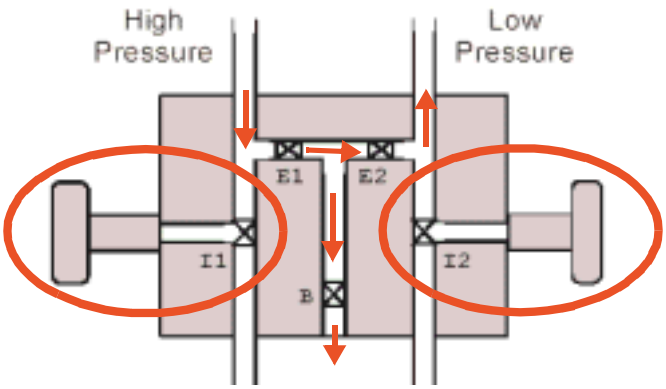


Figure 32 Close I1 & I2.

2 Close B (bleed valve) to make sure the bleed valve is not allowing gas to leak out.

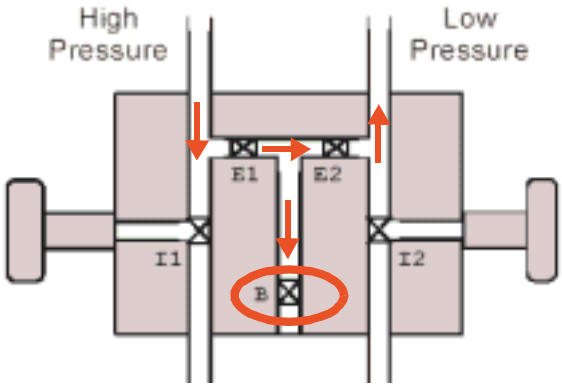


Figure 33 Close B.

3 Open E1 and E2 (equalizing valves) to allow pressure to equalize across the diaphragm in the dual pressure sensor.

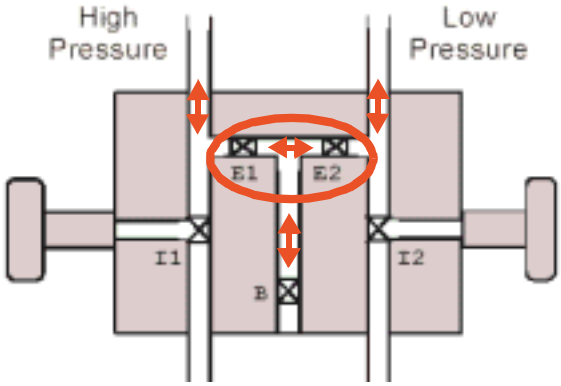


Figure 34 Open E1 & E2

CAUTION

If you open an isolating valve before you equalize the pressure, you can damage the diaphragm inside the pressure sensor.

4 Slowly apply well pressure to the 5-valve manifold by opening the valves for the High and Low pressure lines from the orifice plate.

5 Slowly, carefully, and simultaneously, completely open both I1 and I2 (isolating valves. to equalize the gas pressure across the 5-valve manifold.

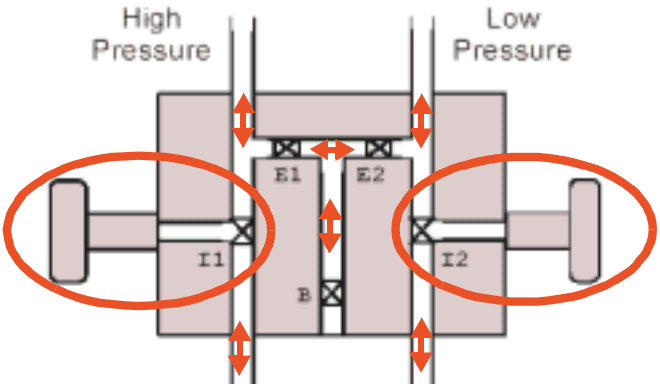


Figure 35 Open I1 & I2.

6 Slowly, and simultaneously, close E1 and E2 (equalizing valves) to reinstate High pressure to the High side and Low pressure to the Low side.

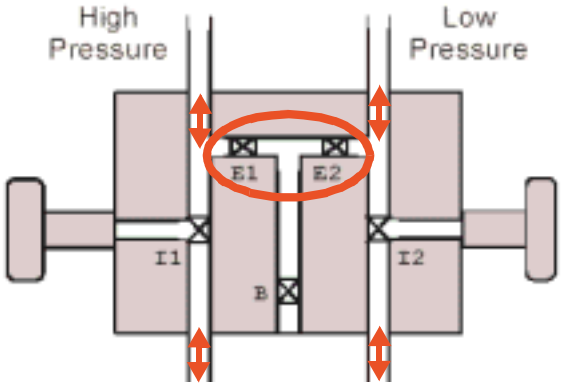


Figure 36 Close E1 & E2.

7 Open B (bleed valve) to vent gas between E1 and E2 to the atmosphere.

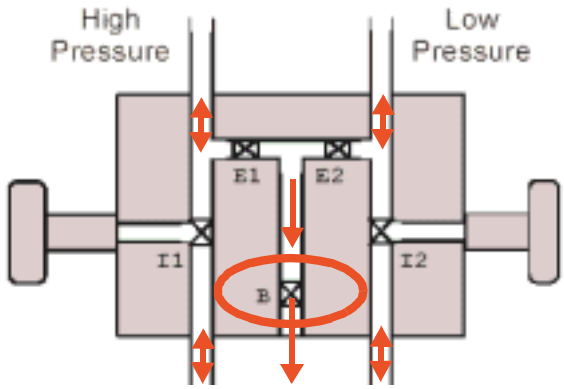


Figure 37 Open B.

NOTE If the pressure sensors are not reading properly, you can momentarily open each equalizing valve (E1 and E2) to remove any possible air lock that might have occurred.

8 Spray leak-detection fluid at connection points (at fittings to tubing connections, etc.) and ensure there are no leaks in the pressure lines.

9 Tighten the fittings as required.

Configuring the Field Instrument

Once the mechanical part of the installation is complete, you need to configure the Field Instrument and enter installation parameters. For complete instructions on configuring the Field Instrument, see the Smart-Alek Communicator Ver. 2.0 User's Manual.

Setting up the Field Instrument consists of:

- Connecting the Laptop to the Field Instrument.
- Starting the Smart-Alek Communicator v2 software, and logging into the Field Instrument.
- Verifying Process and Calibration Values.
- Entering Installation Parameters.
- Checking RF Communication.

Verifying Field Instrument LCD and Readings

Verify the LCD (liquid crystal display) on the front of the Field Instrument by checking that readings are displayed and checking that the readings are reasonable.

➢ **To verify the Field Instrument LCD and readings:**

1 Push the LCD display activation button on the right side of the Field Instrument.

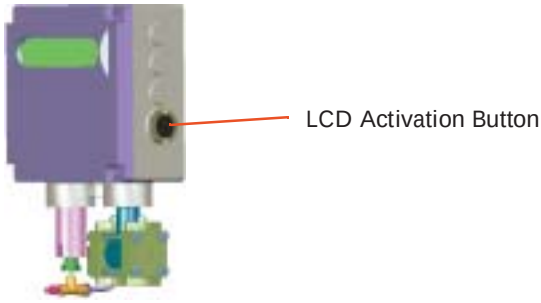


Figure 38 LCD activation button

When the Field Instrument display turns on, these initial eight messages display one after the other:

- **PI.SA** Static pressure. Measured in psig or kPag.
- **PDI.SA** Differential pressure. Measured in IWC (inches of water column) or kPa.
- **TFI.SA** Temperature Flow Indicator. Measured in degrees Fahrenheit or degrees Celsius.
- **KI.SA** Flow rate. Measured in thousands of cubic feet per day or thousands of cubic metres (E3M3) per day.
- **YV** Yesterday's Volume Yesterday's Date. Measured in thousands of cubic feet per day or thousands of cubic metres (E3M3) per day.
- **EI.SA** Voltage of the Field Instrument's Battery. Measured in Volts.
- The current date (today's date). Format: YY/MM/DD The current time. Format: HH:MM:SS
- **FiMODE** Field Instrument Mode and Serial Number
- **Tx** (in lower right corner of display) Modem is on
- **Txc** (in lower right corner of display) Modem is actively transmitting data

Before you leave the site

Before you leave the site, ensure:

- the process and calibration values are verified
- the installation parameters are correct
- the Field Instrument date and time are correct
- the Field Instrument can connect with the zed.i server by performing 3 successful Test Host Connection procedures
- all RF connections are weatherproofed with rubber tape and electrical tape
- the installation report is complete
- you have sign-off for the completed work, on the Field Ticket and on the Site Acceptance Document, from the customer's Field Technician/Operator that is overseeing the work
- the site is cleaned up so it is in the same condition as when you got there

Chapter 6
External Sensors

CAUTION: Static Sensitive Device(s)

Contains components susceptible to damage from Electrostatic Discharge. Handle only using static preventive processes.

In applications where an instantaneous pressure / temperature sample reading is required, such as wellhead tubing and casing pressures, the Smart-Alek can connect to up to two RS-485 Pressure/Temperature sensors.

Recommended mounting on a wellhead is in a horizontal or vertically up position to prevent fluid traps on the pressure sensing element. Physical mounting should be to a union connector rated for on site expected operating pressure.

NOTE Pipeline applications should be through an electrically non-conductive insulating union as some problems have been noted with cathodic protection systems causing interference.

An isolation valve should be installed between the union and the live pressure point. This is to isolate the sensor for trouble shooting, and to allow service crews to safely close in the line, and remove the sensor at the union connection. This has been found to greatly reduce the potential for damage to the sensors and cabling as instrument techs are frequently not at sites during well servicing to assist in removing instrumentation sensors.

The Sensor may be connected to the Field Instrument at distances through a Remote Junction Box and two pair "armored" cable. Each sensor is preprogrammed with a unique address of either 248 or 249. For two sensors to be used on the same wiring bus, they must be equipped with different addresses. For single applications, either address is workable. Wiring diagrams are provided with each Remote Junction Box sent into the field. If more than one unit is being installed, the second sensor will be wired in parallel with the first. The unique address of each sensor will identify it to the Field Instrument.

New readings are only taken from the Sensor when the Smart-Alek is powering up its High Level processor. This occurs when the Field Instrument wakes up at its assigned program time to transmit its data back to the Server, or when a laptop is connecting with the Smart-Alek Communicator software. The reading taken by Smart-Alek Communicator is stored in a buffer until the new one is taken.

NOTE When testing Pressure Sensors and Totalizers with the Real Time Monitor, be aware that the same number will be presented from the buffer continually until it is overwritten by cycling the high level processors. This may give a false indication of a remote accessory being functional or non-functional. The easiest way to test, is to do a soft disconnect with the software, and then reconnect to the tool forcing it to start up its high level processor again.

NOTE Do not remove the thread protector coupling at the bottom of the sensor. This part is included to protect the threads on the more expensive sensor.

NOTE The use of ½ inch unions are recommended to prevent unnecessary twisting of cabling during installation and removal of sensors. Cable should also be restrained with tie wraps or screw in P-clips to prevent damage from wind, animals, or other wellhead servicing work.

Wiring

Up to two contact closure devices can be connected to the Field Instrument. The contact wires are fed through the ports on the left side of the Field Instrument, then attached to the I/O Terminal Block.

➢ **To wire contact closure inputs:**

1 Remove the 1/2” 14 NPT plug from the side of the Field Instrument using a hex wrench.

Figure 39

2 Insert the wire through a weatherproof grommet.

Figure 40

3 Insert the wire through the hole, and tighten the grommet to the Field Instrument.

Figure 41

4 Referring to the wiring diagram located on the inside of the Field Instrument enclosure door, connect the wires to the terminal block. A sample wiring diagram is shown below.

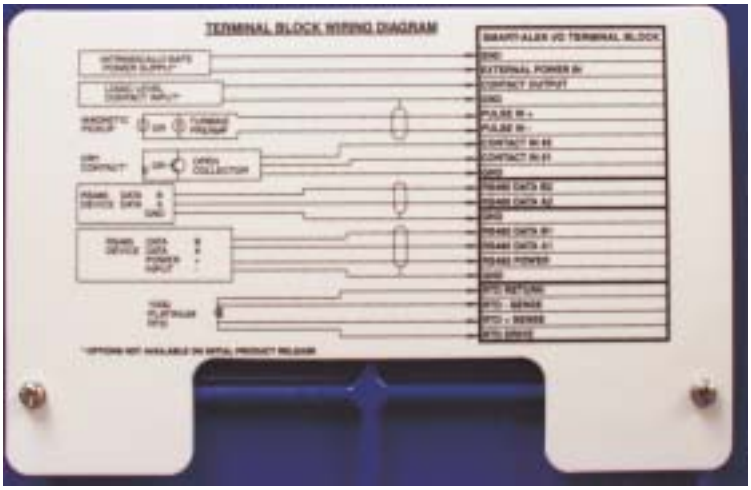


Figure 42 Wiring Diagram on inside front cover of Field Instrument

You can remove the top portion of the terminal block for easier wire connecting. Insert the wire in the side of the terminal block connector, then secure the wire by screwing down the screw on the top of the connector.

Contact Closure

Switch contacts are available on V2.x units set up with HL 2.50.4 (or higher) firmware. See the Smart-Alek Communicator User Guide or help file for more information regarding firmware updates.

This input monitors the status of switch contacts (relay, switch) across a set of open collector inputs.

Do not connect any powered devices to these inputs.

When set for Open, the closing of the contact applies a ground to the sense input indicating a state change. The input can also be set for Closed, and then detect an opening of the contacts. There are two available inputs on the terminal block (contact 1 and contact 2). Activation of the inputs and selecting open /closed status is done under the "Alarms and Exceptions" option from the "Operation" menu. Select 1, and, or 2. Select the alarm state as open, or closed. Select duration time to sense alarm condition. When the input state changes, and holds for the selected time duration the unit will acknowledge the alarm condition. If the unit is in alarm condition during an averaging period (hi level processor cycle = second number in operation programming field) the alarm condition will be forwarded to the server for call out. Alarm status does not indicate on customer web pages. The LCD can be set up to display contact switch status and alarm condition as one of its options.

Contact switch terminations will require an additional 4th wiring termination plug.

No other terminations should be made to the main circuit board as damage may result.

Switches contacts must be of the dry contact type, to work with the open collector inputs.

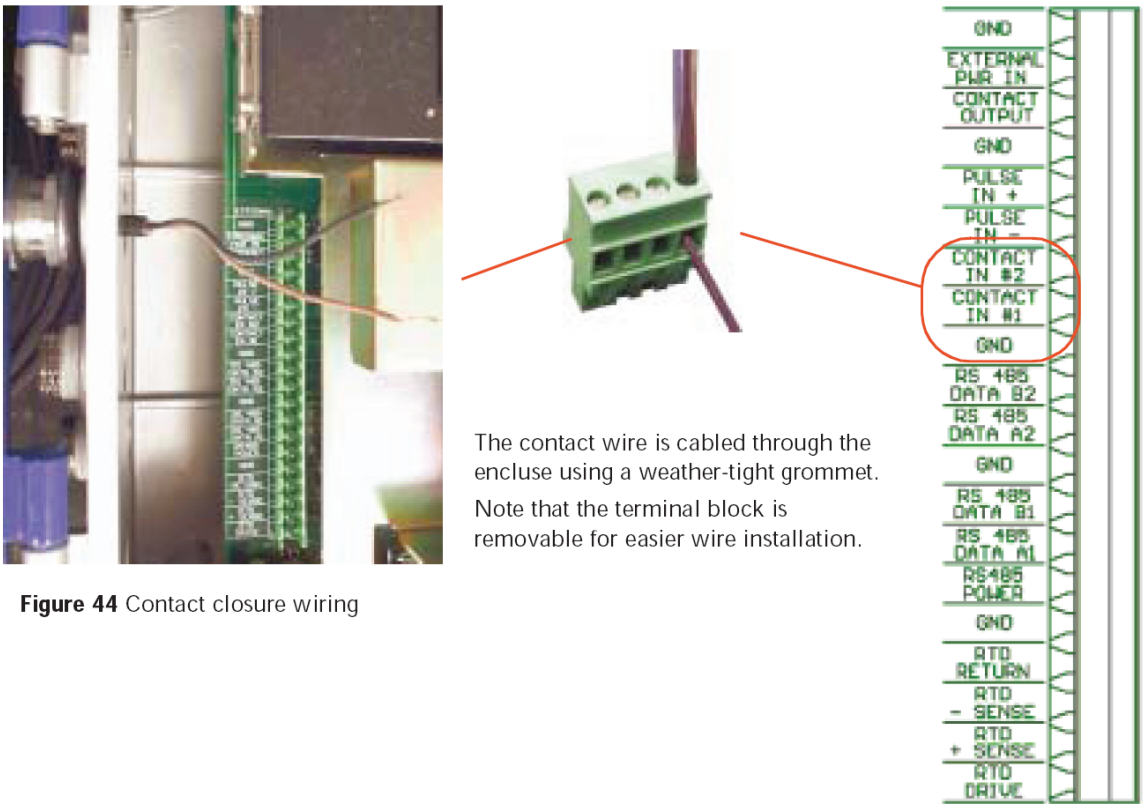


Figure 44 Contact closure wiring

The Field Instrument must also be programmed to acknowledge the presence of the switch inputs. See the Smart-Alek Communicator User Guide for details on programming the Field Instrument.

Electrical Switch Operation	Electrical Contact Position	Real Time Monitor Displays	LCD Displays	To program alarm condition – check contact #, OPEN, and seconds to detect alarm condition	Alarm condition call out occurs when:
Normal @ electrical open		Closed	1	OPEN SECONDS	
Alarm @ electrical close		Open	0 <	open collector Ground	Unit will acknowledge alarm on electrical close of switch after time duration

Electrical Switch Operation	Electrical Contact Position	Real Time Monitor Displays	LCD Displays	To program alarm condition – check contact #, CLOSED, and seconds to detect alarm condition	Alarm condition call out occurs when:
Normal @ electrical close		Open	0	CLOSED SECONDS	
Alarm @ electrical open		Closed	> 1	open collector ground	Unit will acknowledge alarm on electrical open of switch after time duration

Remote Junction Box

Identification

The Remote Junction Box (RJB) is identified as having the smaller 4 pin terminal block mounted inside. There are no factory pre-wired cables attached or installed. The RJB is usually mounted outside most structures at wellheads or pipeline instrumentation points.

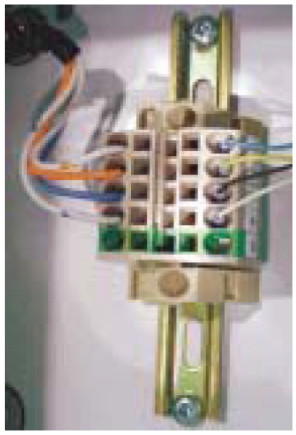


Figure 45 Remote Junction Box

The cover must be closed during normal operation.

Mounting

The box is physically mounted usually in one of two ways. Mounted with 4 screws (self tapping metal tek screws or equivalent) on the wall of the structure. More frequently the RJB must be mounted near a pipeline riser or wellhead. The RJB is not usually mounted to the pipeline pipe or actual wellhead unless as directed by customer.

Mounting is commonly done by bolting the RJB to a short piece of channel strut with spring clips. The channel strut is then bolted or screwed to a nearby piling in the ground, or clamped to a flow line with a pipe clamp. It can also be secured to flow-line insulation by wrapping universal strapping/ banding around the insulation and bolting it to the RJB.
The box must be stable and secure when mounted. Tie wraps and tape are not acceptable.

Cabling

Cabling enters the box through a rubber grommet style cap connector that provides a weather tight seal and a strain relief when tightened down. Refer to current versions of the Smart-Alek wiring diagram for internal electrical connections on the terminal block for any of the available external sensors.

Instrumentation cable runs between the Field Instrument and the Remote Junction Box must be restrained off the ground and away from operating valves or equipment. The method of restraint is up to the customer preference. The two most common methods are using a UV rated tie wrap (28") around the pipe and flowline, or #10 rubber insulated metal P clips screwed to walls, pilings, or insulation covers.

The Remote Junction Box is connected to the Field Instrument via a 2 pair armored instrumentation cable with PVC jacket (Belden 129842, Anixter 317-011-2402A-AJ, or equivalent). Typically the minimum wire size is 24 AWG, and the distance between the box and the Field Instrument usually does not exceed 100 meters (300 feet). Distances longer than this may require a larger cable wire size to minimize resistance in the wiring. Any cabling passing through walls should be in a protective tubing, nipple, or conduit to prevent damage to the cable on sharp edges. Holes between walls or hazardous area zones must also be sealed with silicone, duct seal, or equivalent. to prevent air or gases from transferring through (per Electrical Code requirements).

The use of crimp on ferrules is recommended on wires that have been stripped back for insertion into the terminal blocks. These make the installation easier and reduce the chances of wires coming out, or being damaged by the terminal block connectors.

Appendix A
CID1 to CID2 Sealing

CAUTION: Static Sensitive Device(s)

Contains components susceptible to damage from Electrostatic Discharge. Handle only using static preventive processes.

Fill and seal the hole drilled into the wall of the meter run shelter for the RF/Power cable to meet CLASS I DIV 1, GROUPS C&D Hazardous Locations' Standards using:

- Plastic or metal conduit as required
- 1 lb. Pug Duct Seal or equivalent (Electrical Putty to seal hole for CLASS I DIV 1 inside the meter run shelter)

(Note: Generally, outside the shelter is CLASS I DIV 2.)

Seal outside and internal passages.

Guidelines:

See ANSI/ISA-RP 12.06.01-2003.

Appendix B
Assorted Hardware

Mounting Hardware

2”x4”, 2”/3” x 15” and 2”/3” x 24” pipe mount brackets

Transition bracket

Wall mount solar panel bracket

cross slider

Adapter Plate 4” pipe x V2SA;
Adapter Plate 2”/3” pipe x V2SA

Mast mount solar panel bracket

v2x Field Instrument Bracket

Figure 46

Various fittings for gauge line installation:

male connectors

female connectors

tubing union tees

tubing unions

port connectors

Harware for working with RF cable:

TNC-TNC coupling (female)

N-N coupling (female)

N (male) LMR400/RG58

N (male) LMR200/RG142

Figure 47

Appendix C
Installing Grounding Radials

Usually, grounding radials come pre-installed. However, if they are not pre-installed or require replacing:

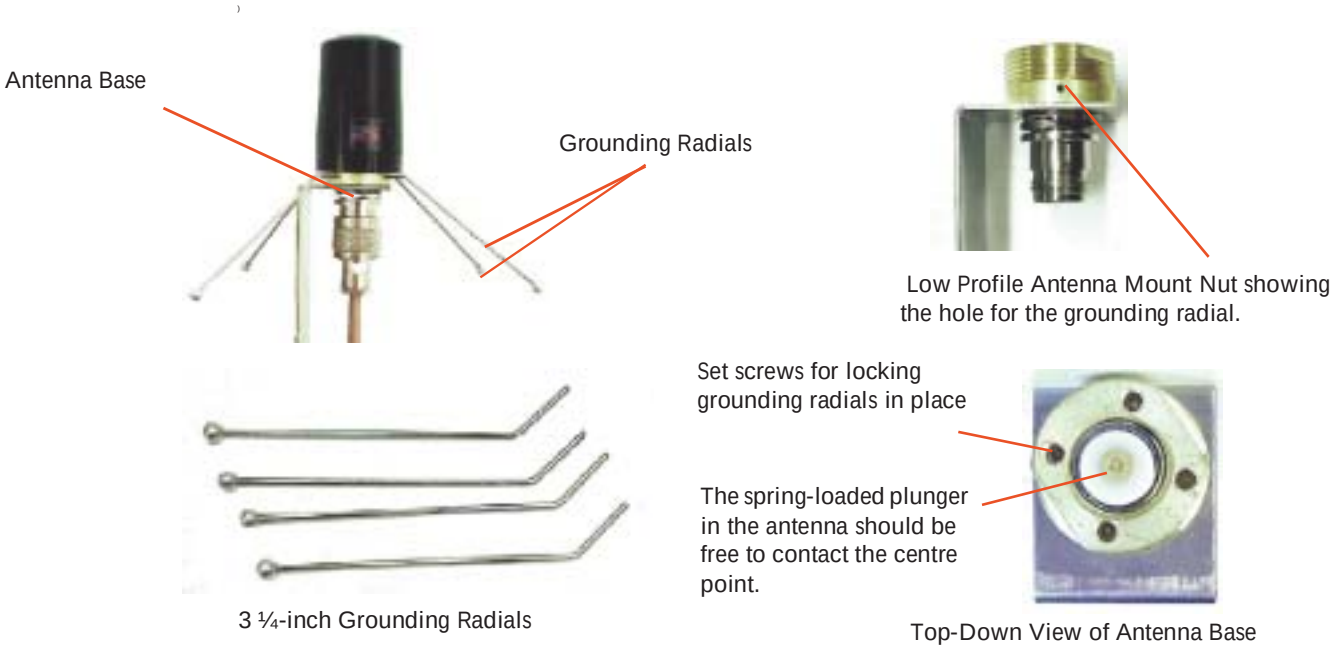


Figure 48 Low Profile Antenna with Grounding Radials Attached

Parts Required

- One Low Profile Antenna for Smart-Alek with Antenna Mounting Bracket (right-angle) attached.
- Four Grounding Radials.
- Hex (Allen) Wrench to tighten the installed set screws.

➢ **To install the antenna's grounding radials:**

1 Unscrew the antenna from the antenna base.

2 Apply a small amount of anti-oxidant dielectric (Suplerlube) grease to the threads.

3 Insert four 3 ¼-inch grounding radials into the mount.

4 Using a hex (Allen) wrench, tighten the set screws to lock the grounding radials into place.

5 Hand-tighten (snugly) the antenna onto the antenna base. Do not over-tighten. Do not use a wrench or pliers etc. to tighten.

Appendix D
Testing previous solar panel/bias tee version

CAUTION: Static Sensitive Device(s)

Contains components susceptible to damage from Electrostatic Discharge. Handle only using static preventive processes.

➢ **To test the solar panel:**

CAUTION

Ground yourself with a wrist strap before removing covers or touching internal components.

1. Ensure the Field Instrument is in Offline Mode.
2. Disconnect the coaxial power/RF cable from the solar panel at the point it attaches to the Field Instrument or satellite modem enclosure.
3. Place the positive lead for the multi-meter on the cable's center pin.
4. Place the negative lead on the outside of the cable's RF connector.

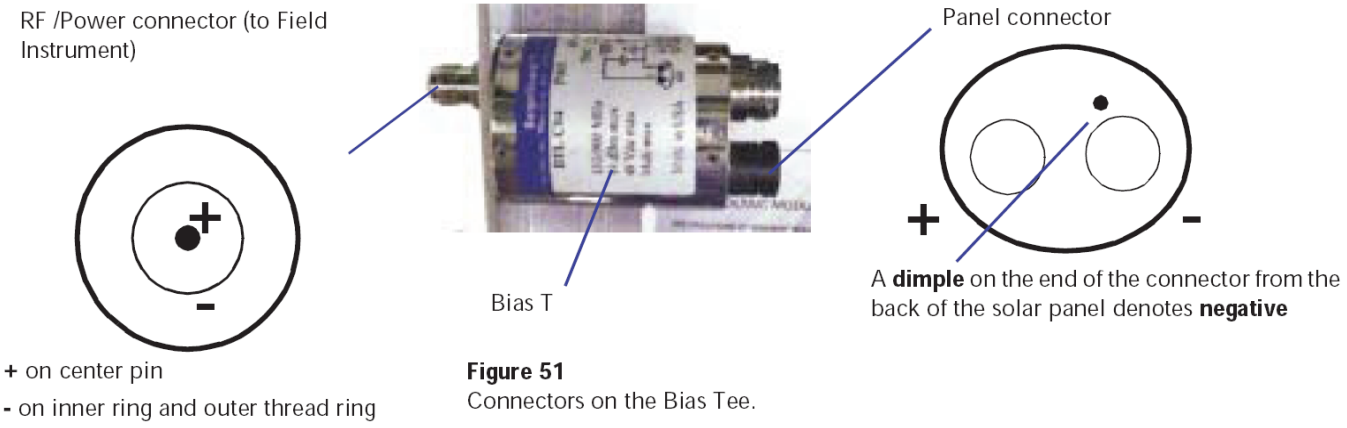


Figure 51
Connectors on the Bias Tee.

CAUTION

When testing voltage, be careful not to short the voltmeter leads.

The voltage should be a minimum of 20 VDC and as high as 25 VDC in direct sunlight. at noon.

The voltage should be a minimum of 18 VDC and as high as 25 VDC in cloudy weather.

If a no voltage or low voltage is displayed:

- Perform a continuity check on the coaxial power/RF cable.
- The solar panel may have to be replaced.

NOTE If the battery's voltage drops below its rating (e.g., if an 8 volt battery drops to 7.9 volts) the Field Instrument will stop communicating with the server (to save power) but will continue to record readings until the battery dies.

If you see a negative voltage:

The wrong leads from your multimeter are on the center pin and outside housing, or some connection further up the line is reversed. Ensure the connector on the two-wire power cable from the back of the solar panel into the bias tee (cylindrical chrome device bolted to the back of the panel) is not on backwards.

5 If voltage is within tolerance, reconnect the coaxial power/RF cable to the Field Instrument.