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Instruction Manual

Model 8040
Wireless Network

(Doc Rev A, 4/16)

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OVERVIEW

The 8040 Series Wireless Vibrating Wire Interface is designed to expand the data collection of the Micro-6000, Micro-1000 and Micro-800 Series Datalogger Wirelessly. Weatherproof packaging allows the unit to be installed in field environments where inhospitable conditions prevail. The Nema 4X enclosure also has a provision for locking to limit access to responsible field personnel.

Available in 2, 4, 16 or 32 channel version (Vibrating Wire plus Thermistor), the 8040 Vibrating Wire Interface is designed around the AVW206 VSPEC interface with built in 900MHz radio. The 2 and 4 channel versions are also available in a rugged watertight PVC tube enclosure. This version (8040T) is particularly useful for installations below grade.

1. HARDWARE

The interface of the 8040 consists of a Campbell Scientific AVW200 with integral spread spectrum radio that allows wireless communications to a Base Datalogger. The AVW206 (900Mhz) and AVW216 (2.4Ghz) allow for wireless RF communications worldwide. The patented VSPECT Vibrating Wire Technology from Campbell Scientific observes the incoming sensor signal, performs a Fourier transform and spectral analysis to determine the largest signal and filter interference. The AVW200 outputs the Sensor Frequency, Amplitude of the single, Signal-to-Noise Ratio, Noise Frequency, and Decay Ratio of the signal and the Sensor Thermistor Reading.

To gain an understanding on the workings and capabilities of the AVW200 it is necessary to read the Overview section of the AVW200 User Manual. The User Manual is available in pdf format at:

https://s.campbellsci.com/documents/us/manuals/avw200.pdf

A provided IP68 rated Regulated AC charger is used to provide the charging voltage for proper maintenance of the installed lead acid battery. An internal power distribution circuit board contains fused terminal blocks used to provide a nominal 12VDC supply for the 8040 Interface. A regulated Solar panel may be used in place of the regulated AC charger assuming the maximum short circuit current does not exceed 6 Amps.

A Multiplexer expands the number of channels that can be read by the 8040 Interface. The channel switching is accomplished by mechanical relays mounted on the underside of the circuit board and the transducer connections are accomplished with wiring terminals. Power, Reset and Clocking for the Multiplexer are supplied by the AVW200. The 4 channel version incorporates a Geokon model 8032 4ch Multiplexer. The 16 and 32 channel versions incorporate Campbell AM16/32 Multiplexer(s).

A 12V – 7Ah lead acid battery is used to provide power for the model 8040. The battery supports operating power for a limited period of time should the AC or solar power, used to maintain the battery, be interrupted. Under normal operating conditions and proper maintenance, the life expectancy of the battery is approximately five (5) years.

A Whip, or External Antenna is connected to the external bulkhead supplied with the 8040 Interface. A wide range of Antenna and Antenna cables can be used depending on site conditions please consult factory for more information.

1.1 Installation

The recommended method of installation involves attaching the to a fixed structure, such as a wall or mounting pole in an upright position **(Figure 1)**. The Antenna will require clear line of sight to the Base Station or nearest Repeater Station. Mounting dimensions shown in inches.

Figure 1 - Typical 8040 Configuration

1.2 Power

After the Interface is installed the Geokon Regulated AC Charger or Regulated Solar Panel can be connected to the 3-Pin Charger Port on the bottom of the enclosure. The supply voltage to the 8040 will be "Off" by default and the On/Off switch SW1 on the Power Distribution circuit board should be switched to the "On" position **(Figure 2)**. The Internal Lead Acid battery will charge in either position. It is recommended that the charger be left plugged in at all times **(Section 3.1).**

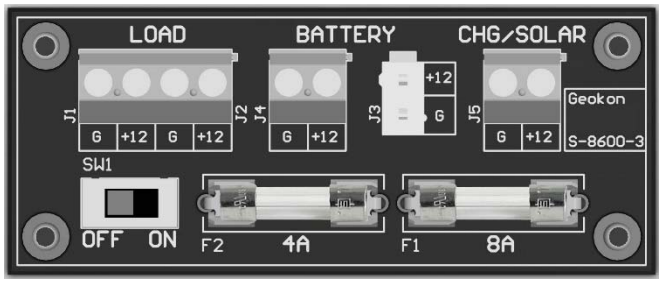


Figure 2 – Power Distribution Circuit Board

1.3 Earth Ground

An earth grounding lug is supplied on the exterior of the 8040 Interface enclosure to connect the system to earth ground **(Figure 3).** A grounding rod can be driven (or other suitable attachment to earth utilized) to ground the system and provide a path to earth for protection against a lightning strike or other transient voltage. A 6' to 8' copper grounding rod connected to the Enclosure grounding lug with a large gauge wire (12 AWG or larger) is recommended. The earth connection should be made as close to the 8040 Interface as possible.

1.4 Gages

Following enclosure installation, Geokon Vibrating Wire sensors can be connected to AVW200 directly or via the Multiplexer(s). Please refer to the Multiplexer instruction manual for the appropriate connection description.

1.5 Communications

Typically, direct communications with the AVW200 are only required during initial configuration. Otherwise, the Datalogger will query the 8040 Interface via RF Radio according to the program. Direct connection is achieved with the supplied RS-232 Serial cable connected to the RS-232 Ports on the AVW200 and computer. A USB to Serial converter (8001-7) is also supplied for connection to the USB port of the computer.

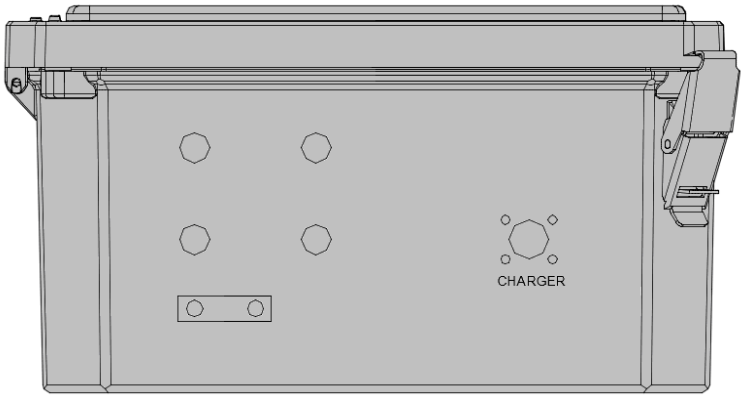


Figure 3 - Typical Bottom View 8040 (4ch)

2. SOFTWARE

Please refer to the Datalogger manual for information on configuration of the Loggernet software and CRBasic program (STARTPROG). Please refer to the Datalogger manual for information on configuration of the Loggernet software and CRBasic program (STARTPROG). The Device Configuration Utility is used to configure the AVW200 Series and can be found under Utilities on the main Loggernet Screen.

3. BATTERY MAINTENANCE

3.1 AC Power

The 8040 Interface is supplied with an external AC to DC Rain Proof Regulated Smart Charger for maintaining the charge of the internal battery which provides power to the Interface. It is imperative that a regulated charging source remain connected as the battery installed is only provided as a temporary source of power should the power supply be disconnected or mains power interrupted. Actual run time, solely on battery power, will vary for each system and depends on the hardware configuration and sensor scan interval. If the battery voltage drops below 9.6 volts operation of the AVW200 will become erratic as evidenced by communication problems and possible improper measurements.

3.2 Solar Power

If AC mains power is not available, a properly sized regulated solar panel can be used to provide power to maintain the charge state of the battery. The size of the solar panel is determined by geographic location of the Datalogger, hardware configuration, communications interval and the sensor scan interval.

3.3 Battery Replacement

If the internal Lead Acid Battery has failed it is recommend that the unit be returned to the factory for service by Geokon personnel. However, with skilled personnel and appropriate tools, it is possible for the user to replace the battery. **Consult the factory for information.**

3.4 Fuses

There are two (2ea) fuses on the internal Power Distribution Board of the 8040 Interface **(Figure 2)**. Once removed and with the power switch off, a fuse can be checked visually and with an ohmmeter. A gap may be evident (with some discoloration) if the fuse needs replacing. This can be verified by a high resistance measurement (mega-ohms) with an ohmmeter. If fuse needs replacing, insert one of the supplied replacement fuses. If there are no replacement fuses available, consult the factory or they can be purchased from an electrical supply house. The F1 charger fuse is an 8 amp SLO-BLO 5x20mm and The F2 fuse is a 4 amp SLO-BLO 5x20mm. Consult Appendix D.6 for fuse assignments.

4. TROUBLESHOOTING

This section will NOT attempt to cover all possible problems that could be encountered in the course of Datalogger operations. Consult the factory if other problems arise or remain unresolved.

- **Cannot communicate directly with the AVW200.**

Suggestions:

1. Ensure Battery Voltage is above 9.6V.

2. Ensure the RS-232 Serial Cable is connected properly.

3. The wrong communication port is being selected in the Device Configuration Software (refer to Device Manager of PC for assigned COM Port). Consult the appropriate software manual for instructions on changing the communication port.

4. The USB communication port on the host computer is defective. Verify the functioning and configuration of the COM port by using it with another USB device, such as a camera or cellular phone.

5. The Load Fuse (F2) on the Power Distribution Board is blown. Consult Section 3.5 for checking and/or replacement.

6. Ensure Default Baud Rate is set to 38400.

- **The system battery voltage and panel temperature read odd numbers.**

Suggestions:

1. The system battery could be low. Charge and check again (see section 3. Battery Maintenance).

2. A disruptive current loop may be operating as a result of improper grounding or excessive noise. Consult the factory for more information.

- **The internal battery measurement does not increase when charging.**

Suggestions:

1. The AC Regulated Charger may be damaged. Check the output pins of the adaptor with a voltmeter.

2. The Charger fuse (F1) of the Power Distribution Board is blown. Consult Section 3.5 for checking and/or replacement.

3. The internal battery is no good. Consult the factory.

4. The Regulated Solar Panel may be damaged, obstructed or have poor sun exposure. Check the output pins of the adaptor with a voltmeter. Verify Solar Panel is not obstructed.

- **Loss of Wireless Communications**

Suggestions:

1. The system has experienced a voltage dropout or surge which disrupted operations.

2. The surge originated as a result of lightning. Install appropriate grounding. Install lightning protection devices on all incoming and outgoing lines (consult factory).

3. Verify Program is running on the Datalogger.

4. Verify Antenna connections and the are no obstructions between line of sight.

5. Refer to Pakbus Graph and confirm Network Settings.

- **Sensor readings show "NAN" or are unstable.**

Suggestions:

1. The wrong sensor type has been connected. Check the model number of the sensor against the requested sensor list.

2. The cable(s) to the sensor(s) have been damaged permitting moisture and debris to enter the jacket. Wires may be shorted together. Inspect the cable and perform Ohm test to check for short circuits.

3. If all sensors on a particular Multiplexer are erratic or returning "NAN" perhaps the Multiplexer damaged. Try a sensor directly connected to the AVW200.

4. The sensor(s) have been damaged. For example, overrange on a vibrating wire sensor can cause erratic readings.

5. There is an electrical noise source nearby. Move the sensor, cables, and Interface away from the noise source. Install grounding devices. Consult the factory.

APPENDIX A - SPECIFICATIONS

A.1 AVW200 Vibrating Wire Interface

Please refer to Campbell Scientifics Specification for the AVW200 Vibrating Wire Interface

https://s.campbellsci.com/documents/us/product-brochures/b_avw200.pdf

A.2 Model 8032 Multiplexer

Please refer to the Geokon Model 8032 Multiplexer Manual.

http://www.geokon.com/content/manuals/8032_Terminal_Board_and_Multiplexer.pdf

A.3 Model AM16/32B Multiplexer

Please refer to Campbell Scientifics Specification for the AM16/32B Multiplexer

https://s.campbellsci.com/documents/us/product-brochures/b_am16-32b.pdf

APPENDIX B - SHIP LIST

B.1 Hardware

The following equipment is included with the system:

- Serial RS-232 Cable 2M
- 8001-7 USB to Serial Adapter
- Small regular screwdriver
- Spare Slo-Blo fuses (3ea) 4Amp and 8Amp
- AC Smart Regulated Charger Rain Proof

The following manuals are included:

- 8040 User Manual
- Campbell Scientific Resource disk
- 8032 or AM16/32B Multiplexer Instruction Manual (if Multiplexers provided)

Optional accessories:

- Regulated Solar Panel with mounting hardware
- Repeater Module
- RF Whip or High Gain Antennas with mounting hardware

Consult the factory for additional information on any of the optional accessories.

APPENDIX C - SYSTEM WIRING

C.1 AVW200 Wiring

AVW200	Direct Connect Sensors	4CH MUX Interface Ribbon Cable	16/32CH MUX Interface Ribbon Cable	Description
1VW+	Red	Brown	Brown	Vibrating Wire +
1VW-	Black	Red	Red	Vibrating Wire -
1T+	Green	Orange	Orange	Thermistor +
1T-	White	Yellow	Yellow	Thermistor -
*2VW+	*Red	*Brown	*Brown	*Vibrating Wire +
*2VW-	*Black	*Red	*Red	*Vibrating Wire -
*2T+	*Green	*Orange	*Orange	*Thermistor +
*2T-	*White	*Yellow	*Yellow	*Thermistor -
CLK	NC	White	White	Multiplexer Clock
RES	NC	Grey	Grey	Multiplexer Enable
G	NC	Black	Black	Ground
AG	Shield	Green	Green	Analog Ground
PWR IN 12V	NC	NC	NC	Power Dis Board Load 12 VDC
PWR IN G	NC	NC	NC	Power Dis Board Load Ground

***NOTE:** Only used with Second Direct Connect Sensor or Second Multiplexer.

The Multiplexer +12VDC and Ground will be wired directly to Power Distribution Board

C.2 Charger Port Wiring

Pin	Description	Wire Color
A	NC	NC
B	Ground	Black
C	Regulated Charger / External Battery	Red

C.3 Regulated Charger (Default)

Pin	Description	Wire Color
A	No Contact	NC
B	Ground	Black (Black Rough)
C	Regulated Charger / External Battery	Red (Black Smooth)

C.4 Fuses on Power Distribution Board

Fuse	Description
F1	8Amp Charger / External Battery
F2	4Amp Battery / Load

APPENDIX D – Network Configuration

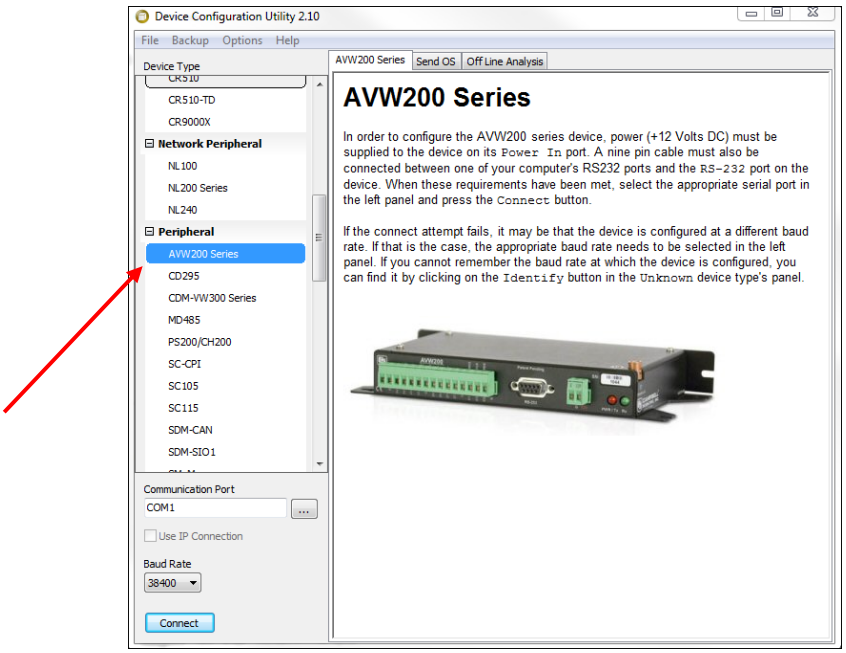
D.1 Overview

In most cases the 8040 will come configured directly from Geokon for a specific Network. Settings may need to be re-configured due to interference, other networks or communications issues. It is not recommended to have more than 10ea 8040s / Repeaters connected to a single Base Station. Different Base Stations should be configured on a separate PakBus Network. Pakbus Graph is a visual tool that allows troubleshooting of the Network setup.

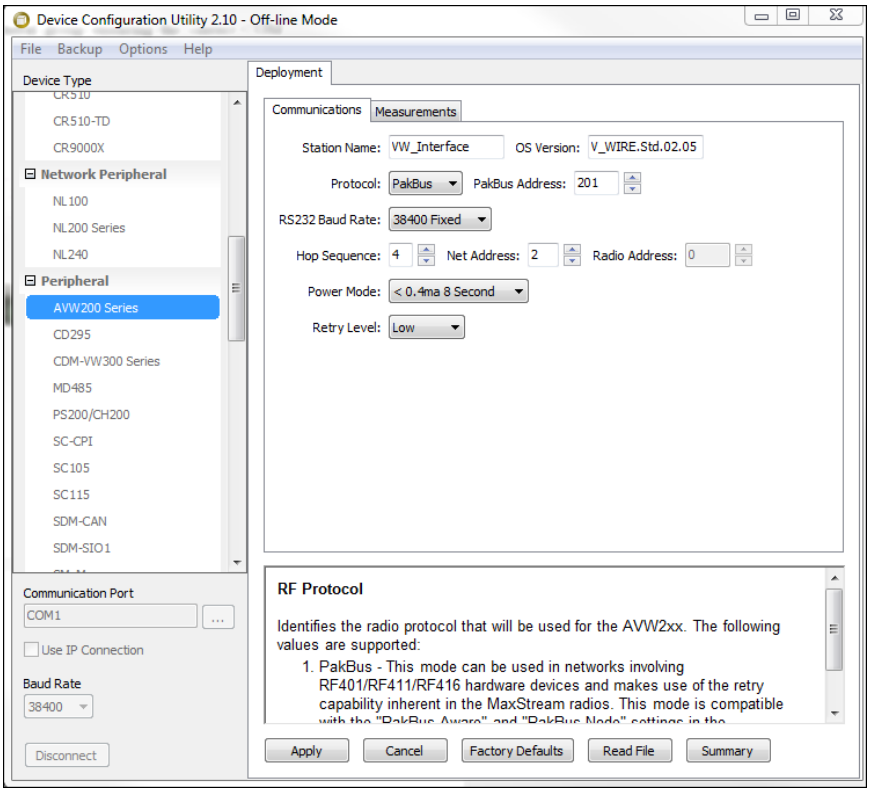
D.2 Device Configuration

With the Loggernet Launch Menu open, hover over “Utilities” and press “Device Config Utility” from the resulting list of applications.

In Device Type, Select “AVW200” from the Peripheral group ensuring the correct COM Port is selected.

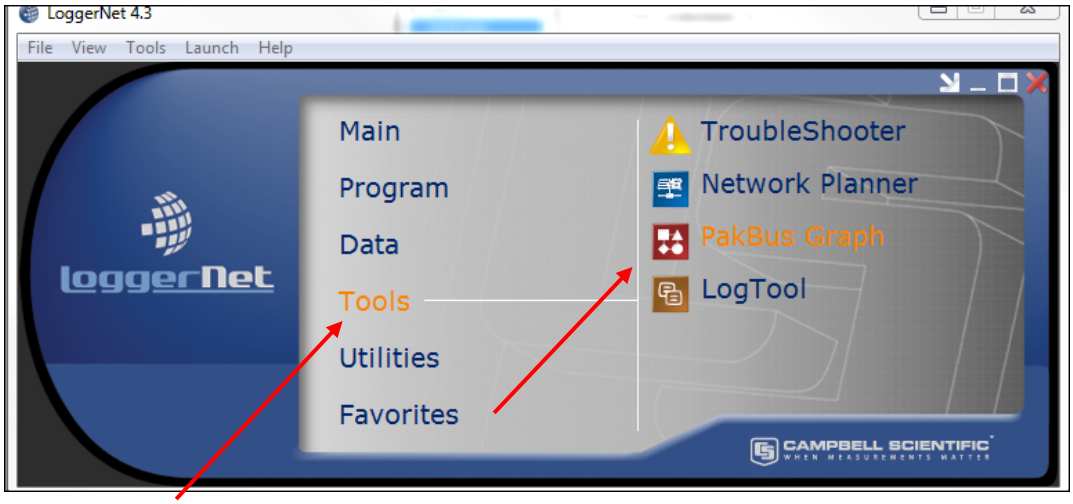


All radios in the same Network must have the same Hop Sequence, Net Address and Power Mode. Each Pakbus Node will require a unique PakBus Address. In a typical Network, Bases Station Dataloggers will have a PakBus Address starting with 1, Repeaters with 101 and 8040 Interface nodes with 201. All other settings should remain default for standard Networks. Line of sight between Base / Repeater is required for proper communications.

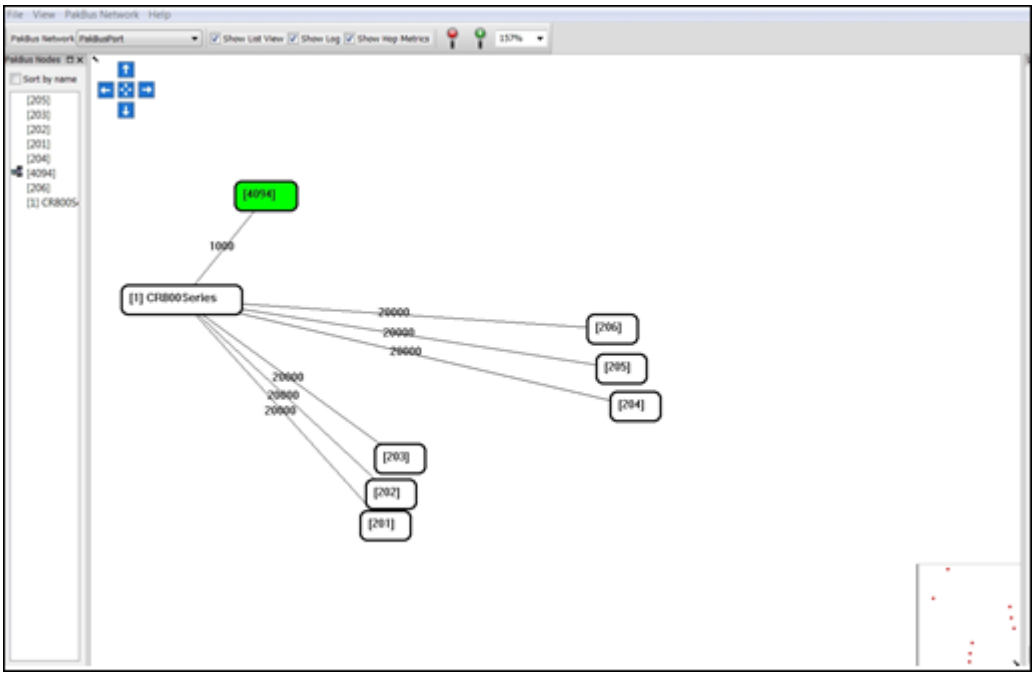


D.3 Pakbus Graph Tool

With the Loggernet Launch Menu open, hover over “Tools” and press “Device Pakbus Graph” from the resulting list of applications.



Pakbus Graph allows you to see all Pakbus Neighbors connected to Loggernet and make quick changes to the settings and troubleshoot communication issues.



PLEASE SEE LOGGERNET , RF RADIO AND AVW200 MANUALS FOR MORE SPECIFIC DETAILS REGARDING SETTINGS IN THE DEVICE CONFIGURATION AND PAKBUS GRAPH SOFTWARE

APPENDIX E – Repeater

E.1 OVERVIEW

The 8040 Series Network can be used with up to eight (8) 8040-1 RF Repeaters. The 8040-1 Repeater is designed around the RF4XX series radio modules. The Model of the radio will depend on the frequency of the existing network. Repeaters allow for communications with the base station when Line of Sight is not achievable.

E.2 HARDWARE

The interface of the 8040-1 Repeater consists of a Campbell Scientific RF4XX spread spectrum radio that allows wireless communications to a Base Datalogger. The RF401A (900Mhz) and RF416 (2.4Ghz) allow for wireless RF communications worldwide.

To gain an understanding on the workings and capabilities of the RF4XX Series Radio Modems it is necessary to read the Overview section of the RF Radio User Manual. The User Manual is available in pdf format at:

https://s.campbellsci.com/documents/us/manuals/rf401a-series.pdf

A provided IP68 rated Regulated AC charger is used to provide the charging voltage for proper maintenance of the installed lead acid battery. An internal power distribution circuit board contains fused terminal blocks used to provide a nominal 12VDC supply for the 8040 Interface.

A regulated Solar panel may be used in place of the regulated AC charger assuming the maximum short circuit current does not exceed 6 Amps.

A 12V – 7Ah lead acid battery is used to provide power for the model 8040-1 Repeater. The battery supports operating power for a limited period of time should the AC or solar power, used to maintain the battery, be interrupted. Under normal operating conditions and proper maintenance, the life expectancy of the battery is approximately five (5) years.

A Whip, or External Antenna is connected to the external bulkhead supplied with the 8040-1 Repeater. A wide range of Antenna and Antenna cables can be used depending on site conditions please consult factory for more information.

In most cases the 8040-1 Repeater will come configured directly from Geokon for a specific Network. Settings may need to be re-configured due to interference, other networks or communications issues. It is not recommended to have more than 10ea 8040s / Repeaters connected to a single Base Station. Different Base Stations should be configured on a separate PakBus Network. Pakbus Graph is a visual tool that allows troubleshooting of the Network setup.

Please refer to sections 1-3 in the complete 8040 Manual for information on enclosure installation and maintenance.

APPENDIX F – 8040T Tube Interface

F.1 OVERVIEW

The 8040T Tube Interface is designed around a Campbell Scientific AVW200 with integral spread spectrum radio that allows wireless communications to a Base Datalogger. The AVW206 (900Mhz) and AVW216 (2.4Ghz) allow for wireless RF communications worldwide. The patented VSPECT Vibrating Wire Technology from Campbell Scientific observes the incoming sensor signal, performs a Fourier transform and spectral analysis to determine the largest signal and filter interference. The AVW200 outputs the Sensor Frequency, Amplitude of the single, Signal-to-Noise Ratio, Noise Frequency, and Decay Ratio of the signal and the Sensor Thermistor Reading. The 8040T Tube Interface is available in 2 and 4 channel versions in a rugged weatherproof PVC tube enclosure. This version (8040T) is particularly useful for installations below grade and is typically used with an external Manhole Antenna.

F.2 HARDWARE

The interface of the 8040T consists of a Campbell Scientific AVW200 with integral spread spectrum radio that allows wireless communications to a Base Datalogger. The AVW206 (900Mhz) and AVW216 (2.4Ghz) allow for wireless RF communications worldwide.

To gain an understanding on the workings and capabilities of the AVW200 it is necessary to read the Overview section of the AVW200 User Manual. The User Manual is available in pdf format at:

https://s.campbellsci.com/documents/us/manuals/avw200.pdf

Four (4) internal D-Cell Lithium Batteries (NON-RECHARGABLE) provide a nominal 12VDC supply for the 8040T Tube Interface.

Under normal operating conditions and proper maintenance, the life expectancy of the batteries is based upon site conditions, RF signal strength, temperatures, scan interval and configuration. Please consult factory for a more information regarding battery life of the 8040T Interface.

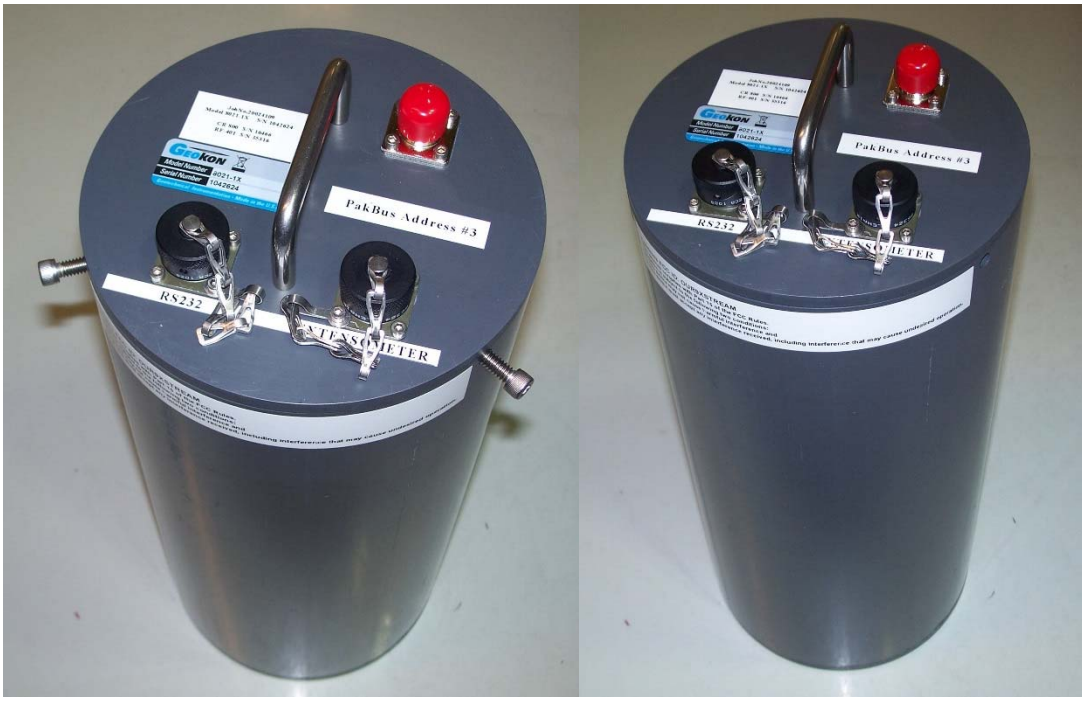
A External Antenna is connected to the external bulkhead. A wide range of Antenna and Antenna cables can be used depending on site conditions please consult factory for more information. A typical Antenna used with the 8040T Tube Interface is a flush mount Manhole Antenna for use in heavy traffic areas.

In most cases, the 8040T Tube Interface will come configured directly from Geokon for a specific Network. Settings may need to be re-configured due to interference, other networks or communications issues. It is not recommended to have more than 10ea 8040s / Repeaters / 8040Ts connected to a single Base Station. Different Base Stations should be configured on a separate PakBus Network. Pakbus Graph is a visual tool that allows troubleshooting of the Network setup.

Please refer to sections 1-3 in the complete 8040 Manual for information on enclosure installation and maintenance.

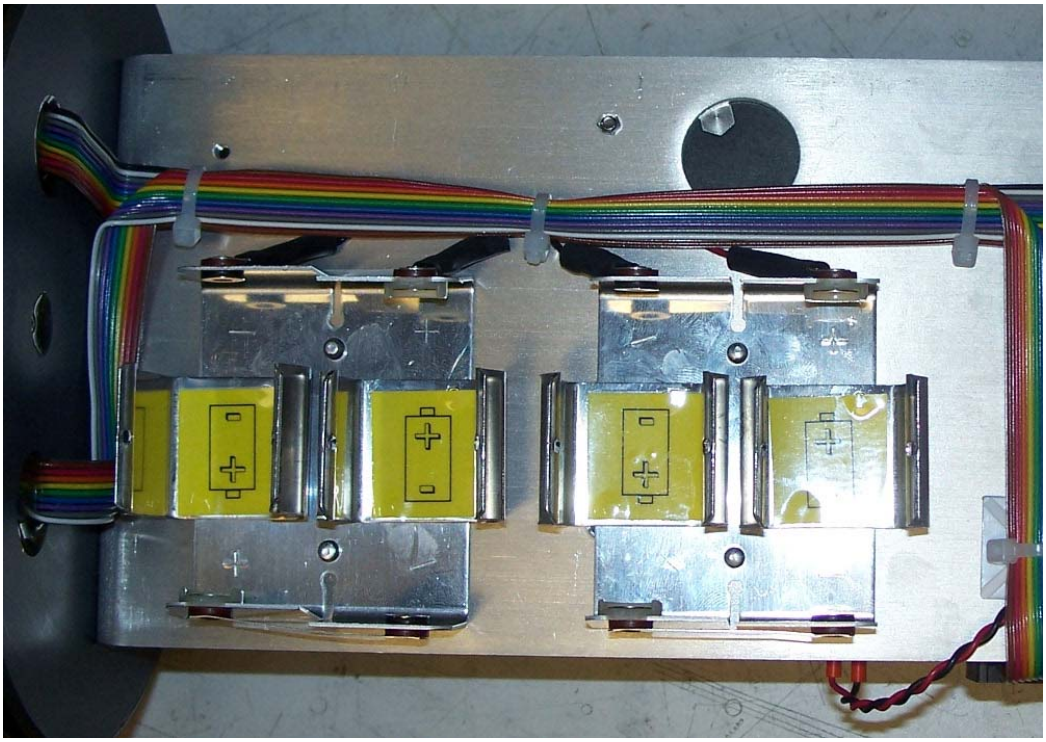
F.3 Battery Replacement

Remove all three machine screws from the top of the Tube Logger using a 3/16” Allen key.



Firmly grip the bottom of the Tube Logger with your feet or have someone hold it if you have help. Holding the top handle, gently pull upward to remove from the casing.

Place the 8040T Interface on its side and install batteries according to the diagram.



With batteries installed, gently lower the Datalogger into its enclosure. Once the O-ring seats on the shoulder press down firmly until the top is flush with the bottom. Re-install the three machine screws with a 3/16” Allen key. Do not over tighten.