**Stevens Hydra Probe Soil Sensor**  
0 - 2.5 V Analog Output

**Description**

Stevens patented Hydra Probe design is unique compared to other soil moisture probes because the electrical response of soils can be specified by two parameters, the dielectric constant and the conductivity. The dielectric constant is most indicative of water content while the conductivity is strongly dependent on soil salinity. Unlike other capacitance type sensors, the Hydra Probe measures both of these components simultaneously. The high frequency electrical measurements indicating the capacitive and conductive properties of soil are then directly related to the soil’s moisture and salinity content while a thermistor determines soil temperature. These unique sensors feature all three simultaneous readings for more definitive analysis of soil conditions.

The small, precisely defined sensing area allows accurate measurements in regions where there are strong soil moisture gradients, such as near the soil surface. Response time is immediate to changing soil moisture conditions, and no calibration is required. Equipped with a direct burial connecting cable, the Hydra Probe allows for data collection over a large study area in a variety of soil conditions.

The data reduction algorithm converts analog voltages to the following outputs: the real and imaginary dielectric constant, temperature, temperature corrected real and imaginary dielectric constants, water content, soil salinity (indicative of nitrate levels), soil conductivity, temperature corrected soil conductivity and temperature corrected soil water conductivity.

The provided data reduction program can operate on a PC or Smart Logger file of raw sensor input data, and output a file consisting of processed data, or the program performs the data reduction algorithm on the data in an ASCII file download format from Stevens hand held data reader.

A rugged design with all internal components potted for a robust, zero maintenance design makes the Hydra Probe ideal for remote and environmental hostile conditions. This durable construction makes it possible for the unit to remain in the field for many years, maintenance free.

**Features**

- Simultaneously measures:
  - Soil moisture
  - Soil salinity
  - Soil temperature
- Instantaneous sensor response
- No calibration requirements
- Compact, rugged, no maintenance design
- The dielectric constant, soil moisture, and conductivity accuracy measurements are improved using 1 of 3 soil calibration constants
- Compatible with most data logging systems with multiple analog inputs

**Applications**

- Long-term monitoring or spot checking of soil moisture, conductivity, and temperature for:
  - Irrigation management
  - Geotechnical studies
  - Weather/climate studies
  - Watershed management
  - Flood control forecasting

www.stevenswater.com  
1.800.452.5272
Hydra Probe Sensor

Technical Specifications

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Constant</td>
<td>1 to 65 where 1 = air</td>
<td>± 1.5% or 0.2 whichever is typically greater</td>
</tr>
<tr>
<td></td>
<td>78 = distilled water</td>
<td></td>
</tr>
<tr>
<td>Soil Moisture</td>
<td>From completely dry to fully saturated</td>
<td>± 0.03 water fraction by volume in typical soil</td>
</tr>
<tr>
<td>Conductivity</td>
<td>0-20 dS/m</td>
<td>± 2.0% or 0.002 dS/m whichever is typically greater</td>
</tr>
<tr>
<td>Temperature</td>
<td>-10° to +65° C</td>
<td>± 0.6° C</td>
</tr>
</tbody>
</table>

ENVIRONMENTAL

Operating Temperature
- In soils: freezing to +65° C
- Temperature range: -10° to +65° C

Storage Temperature
-40° to +70° C

Water Resistance
- Tolerates continuous full immersion

PHYSICAL PARAMETERS

Size
- Length: 4.9 inches (12.4 cm)
- Diameter: 1.6 inches (4.2 cm)

Sensing Volume (cylindrical region)
- Diameter: 1.2 inches (3.0 cm)
- Length: 2.2 inches (5.7 cm)

Weight
- 200 g not including cable
- (Cable weight approx 0.08 kg/meter)

PHYSICAL PARAMETERS (cont.)

Ruggedness/Material
- Vibration and shock resistant with pot-ted components in PVC housing and marine-grade stainless steel tines

ELECTRICAL OPERATION

Data Channels
- Four (4) 0-2.5 volt analog output signals. V1, V2 and V3 are used to determine the capacitive and conductive response, and hence water content and salinity, of soil. V4 is for soil temperature.

Cable
- Seven (7) wire color-coded 18 AWG copper wire, length up to 100 ft. UV resistant, direct burial cable.

Power
- 7 to 30 volts DC, typically 20mA, 40 mA maximum

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>70030-025</td>
<td>Stevens Hydra Probe with 25’ of cable, 0 - 2.5 Volt Output</td>
</tr>
<tr>
<td>70030-050</td>
<td>Stevens Hydra Probe with 50’ of cable, 0 - 2.5 Volt Output</td>
</tr>
<tr>
<td>70030-100</td>
<td>Stevens Hydra Probe with 100’ of cable, 0 - 2.5 Volt Output</td>
</tr>
</tbody>
</table>

Looking for a Hydra Probe with DIGITAL output? The Stevens Hydra Probe II offers digital SDI-12 or RS-485 outputs, with 21 user-selectable parameters. Learn more online at http://www.stevenswater.com/soil_moisture_sensors/index.aspx or call Stevens Water toll-free at (800) 452-5272 or (503) 445-8000.
SDX Pressure Sensor DATA SHEET

Description

The Stevens SDX (Submersible Depth Transmitter) is a pressure sensor that delivers accurate results while still remaining very affordable for a wide range of level measurement applications.

High impact, corrosion-resistant PVC Type II housing and potted electronics make the SDX extremely durable for most water and hostile fluid environments. The SDX is also an excellent choice for level measurement application that may put more expensive sensors at risk for damage.

The SDX comes equipped with user specified vented cable lengths. The vent provides an atmospheric reference for the sensor, which is necessary for ensuring the highest possible accuracy when making a level measurement.

The SDX features one 4-20 mA analog output signal that corresponds linearly to range. Compatible with existing power and data logging instruments, the SDX can easily be deployed for data collection at remote monitoring sites.

The sensor housing features pipe threads for securely mounting the SDX into pipes, tanks, or other applications (see technical specifications for thread measurements).

www.stevenswater.com  1.800.452.5272

Features

• Rugged housing and fully potted electronics - no risk of leaking
• Compact size
• Accuracy of ± 0.25% full span
• Analog output (4-20 mA)
• Operating temperature from -40° F to 185° F (-40° C to 85° C)
• Not damaged by freezing water
• Vented cable, 2 wire, with drain User specified length
• Threaded housing for secure installation into pipes, tanks, and other applications
• Weighted copper nose cone

Applications

• Well Monitoring
• Ground water monitoring
• Surface water monitoring
• Tank level monitoring
• Soil & ground water remediation
• Environmental impact and research studies
• Harsh environments
SDX Pressure Sensor DATA SHEET

The pressure transducer used is a “Wet-Wet” device. While it is important to keep the SDX cable’s vent tube unobstructed for barometric pressure compensation, this feature means neither the pressure transducer nor internal electronics are damaged by condensation or moisture entering the vent tube. For best results, Stevens recommends the desiccant cartridge with vent tube adapter.

Technical Specifications

<table>
<thead>
<tr>
<th>Power Requirements</th>
<th>14 - 35 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>4-20 mA current signal, linearly corresponding to range</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40° F to 185° F (-40° C to 85° C)</td>
</tr>
<tr>
<td>Compensated Temperature</td>
<td>32° F to 122° F (0° C to 50° C)</td>
</tr>
<tr>
<td>Linearity</td>
<td>0-10 ft range: 0.2% max</td>
</tr>
<tr>
<td></td>
<td>0-35 ft range: 0.3% max</td>
</tr>
<tr>
<td></td>
<td>0-50 ft range: 0.3% max</td>
</tr>
<tr>
<td></td>
<td>(0.1% typical for all ranges)</td>
</tr>
<tr>
<td>Repeatability &amp; Hysteresis</td>
<td>Typical: ± 0.2% span</td>
</tr>
<tr>
<td>Reverse Polarity Protection</td>
<td>Built into sensor</td>
</tr>
<tr>
<td>Overpressure</td>
<td>0-5 ft: 20 psi max</td>
</tr>
<tr>
<td></td>
<td>0-10 ft: 20 psi max</td>
</tr>
<tr>
<td></td>
<td>0-35 ft: 45 psi max</td>
</tr>
<tr>
<td></td>
<td>0-50 ft: 45 psi max</td>
</tr>
<tr>
<td>Shock</td>
<td>Qualification tested to 150 g</td>
</tr>
<tr>
<td>Wiring</td>
<td>Red: power</td>
</tr>
<tr>
<td></td>
<td>Green: 4-20 mA return</td>
</tr>
<tr>
<td></td>
<td>Silver: drain wire</td>
</tr>
<tr>
<td>Pipe Threading</td>
<td>1/2-14 Straight Pipe Thread</td>
</tr>
<tr>
<td></td>
<td>(back of sensor housing near cable)</td>
</tr>
<tr>
<td></td>
<td>3/8-18 Straight Pipe Thread</td>
</tr>
<tr>
<td></td>
<td>(under removable copper nose-cone)</td>
</tr>
<tr>
<td>Physical Size (L x D)</td>
<td>3.63 in x 0.84 in</td>
</tr>
<tr>
<td></td>
<td>(92.20 mm x 21.33 mm)</td>
</tr>
<tr>
<td>Weight (approximate)</td>
<td>Probe: 4.83 oz</td>
</tr>
<tr>
<td></td>
<td>Cable: 0.43 oz per foot</td>
</tr>
</tbody>
</table>

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>93720-005</td>
<td>SDX Pressure Transducer, 0-5 ft range w/o cable</td>
</tr>
<tr>
<td>93720-010</td>
<td>SDX Pressure Transducer, 0-10 ft range w/o cable</td>
</tr>
<tr>
<td>93720-035</td>
<td>SDX Pressure Transducer, 0-35 ft range w/o cable</td>
</tr>
<tr>
<td>93720-050</td>
<td>SDX Pressure Transducer, 0-50 ft range w/o cable</td>
</tr>
<tr>
<td>44049</td>
<td>Vented cable, 2 wire, with drain</td>
</tr>
<tr>
<td>93030-010</td>
<td>Desiccant cartridge with vent tube adapter, 10 cm length</td>
</tr>
<tr>
<td>93030-001</td>
<td>Desiccant cartridge with vent tube adapter, 20 cm length</td>
</tr>
</tbody>
</table>
This user guide describes how to use the NI WSN-3202 analog input node and lists its specifications. Figure 1 shows the NI WSN system components.

The NI WSN-3202 is a four-channel, low-power, wireless voltage input device that works with other NI WSN-32xx nodes and gateways to form a wireless sensor network. The NI WSN system consists of one or more NI WSN gateways, up to 36 NI WSN-32xx nodes per gateway, and multiple PCs or Programmable Automation Controllers (PACs) to receive and analyze the distributed sensor data. For more information about PACs, visit ni.com.
When you connect the NI WSN gateway, you can use a separate host PC running Windows, or a PAC running NI LabVIEW Real-Time, to display measurement results, status information, and to change the NI WSN gateway and NI WSN-3202 device settings. Figure 2 shows the NI WSN-3202 device block diagram.

![NI WSN-3202 Block Diagram](image)

**Figure 2.** NI WSN-3202 Block Diagram
Dimensions

Figure 3 shows the NI WSN-3202 device dimensions.

![Device Dimensions Diagram]

**Safety Guidelines**

Operate the NI WSN-3202 device only as described in this user guide.

**Hot Surface**  This icon denotes that the component may be hot. Touching this component may result in bodily injury.

**NI WSN Safety Information**

The following section contains important safety information that you must follow when installing and using NI WSN products.

**Caution**  Do not operate the NI WSN product in a manner not specified in the user manual or operating instructions. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to National Instruments for repair.

**Caution**  Do not substitute parts or modify the NI WSN product. Use the product only with the devices, accessories, and cables specified in the installation instructions.
Caution Do not operate NI WSN products in an explosive atmosphere or where there may be flammable gases or fumes.

Caution If you need to clean a NI WSN product, wipe it with a dry towel. The product must be completely dry and free from contaminants before you return it to service.

Caution Operate the product indoors only at or below Pollution Degree 2. Pollution is foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength or surface resistivity.

Caution You must insulate signal connections for the maximum voltage for which the NI WSN product is rated. Do not exceed the maximum ratings for the product. Do not install wiring while the product is live with electrical signals. Do not remove or add connector blocks when power is connected to the NI WSN system. Avoid contact between your body and the connector block signal wiring when hot-swapping devices.

Caution To comply with safety regulations, use only recommended batteries with this product. Refer to the Battery Power section for the recommended battery types.

Safety Guidelines for Hazardous Locations
The NI WSN-3202 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nC IIC T4 and Ex nL IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI WSN-3202 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.

Safety Guidelines for Hazardous Locations
The NI WSN-3202 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nC IIC T4 and Ex nL IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI WSN-3202 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.

Caution Observe the battery manufacturers’ operating temperature ratings listed in the Battery operating temperature range specification section.

Caution Do not disconnect the power supply wires and connectors from the device unless power has been switched off.

Caution Do not install or remove the device unless power has been switched off.

Caution Substitution of components may impair suitability for Class I, Division 2.

Caution For Zone 2 applications, install the WSN system in an enclosure rated to at least IP 54 as defined by IEC 60529 and EN 60529.

Special Conditions for Hazardous Locations Use in Europe
The NI WSN-3202 has been evaluated as Ex nA nL IIC T4 equipment under DEMKO Certificate No. 07 ATEX 0626664X. Each device is marked II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of $-40 \degree C \leq T_a \leq 70 \degree C$. 
Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) as stated in the product specifications. These requirements and limits are designed to provide reasonable protection against harmful interference when the product is operated in its intended operational electromagnetic environment.

This product is intended for use in industrial locations. There is no guarantee that harmful interference will not occur in a particular installation, when the product is connected to a test object, or if the product is used in residential areas. To minimize the potential for the product to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

The following statements contain important EMC information needed before installing and using this product:

⚠️ **Caution** To ensure the specified EMC performance, product installation requires either special considerations or user-installed, add-on devices. See the product installation instructions for further information.

⚠️ **Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

⚠️ **Caution** This product may become more sensitive to electromagnetic disturbances in the operational environment when test leads are attached or when connected to a test object.

Related Documentation

Check [ni.com/manuals](http://ni.com/manuals) for the most recent documentation. For a complete list of documentation related to the NI WSN system, refer to [ni.com/info](http://ni.com/info) and enter rdwsnrd.

In addition to this guide, the following documents may be useful when configuring your NI WSN system:

- *NI Wireless Sensor Network Getting Started Guide*
- *NI WSN-9791 Ethernet Gateway User Guide and Specifications*
- *NI 9792 WSN Real-Time Gateway User Guide and Specifications*
- *Configuring WSN in MAX*, available from *Start»All Programs»National Instruments»NI-WSN*
- *LabVIEW Help for WSN Devices*, available in LabVIEW from *Help»LV Help»WSN Devices Help*
- *NI-WSN Readme*, available on the software installation disc included with your gateway

Training Courses

If you need more help getting started developing an application with NI products, NI offers training courses. To enroll in a course or obtain a detailed course outline, refer to [ni.com/training](http://ni.com/training).

Technical Support on the Web

For additional support, refer to [ni.com/support](http://ni.com/support) or [zone.ni.com](http://zone.ni.com).
Software Overview

Note Refer to the *NI WSN Readme*, available on the software installation disc included with your device, for NI software application version support.

The NI-WSN software includes NI Measurement & Automation Explorer (MAX) as well as server and driver software for easy integration into application software packages. These software components manage the low-level communications and hardware configurations, simplifying programmatic access to I/O channels. The NI-WSN software is on the software installation disc included with your NI WSN gateway device. The NI-WSN software is supported by Windows 7/Vista/XP and contains the following components:

- NI MAX
- NI-WSN

You can download a current version of NI-WSN software from ni.com/support. Using your Web browser, go to ni.com/support and select Drivers and Updates»Distributed I/O»Wireless Sensor Networks, and then select the latest version of NI-WSN software. If you are using other software, refer to the installation instructions that accompany your software.

What You Need to Get Started

To set up and use NI LabVIEW with the NI WSN-3202 device, you need the following:

- NI WSN gateway
- NI WSN 32xx devices with a 9–30 V power supply or four AA 1.5 V alkaline batteries for each node. Refer to the Battery Power section for recommended batteries.
- Mounting hardware (DIN rail, panel-mount, or rack mount accessory)
- Ethernet cable/connection
- 1/8 in. flathead and number 2 Phillips screwdrivers
- NI-WSN software version 1.0 or later
- Host PC running Windows 7/Vista/XP
- NI LabVIEW 8.6.1 (32-bit) or later
- (NI 9792 WSN Real-Time Gateway Only) NI LabVIEW 2009 SP1 (32-bit) Real-Time Module or later
- Related hardware and software documentation

Unpack the Device and Install the Antenna

Remove the device from the package and inspect the device. Contact NI if the device appears damaged. Do not install a damaged device.

Caution The device is static sensitive. Always properly ground yourself and the equipment when handling or connecting to the device.

To attach the antenna, align the antenna with the mount and screw it on as shown in Figure 4.

Caution The antenna must be attached to the NI WSN devices in order for the NI WSN devices to function correctly.
You can mount the NI WSN-3202 on a panel or on a 35 mm DIN rail. For kit accessory ordering information, refer to the NI WSN product page accessory section at ni.com. Before using any of these mounting methods, remove and save the serial number sticker located on the back of the NI WSN-3202 device for future use when configuring your device in software. For the NI WSN-3202 device dimensions, refer to Figure 3.

**Caution**
Your installation must allow 50.8 mm (2 in.) of clearance in front of devices for common connector cabling, such as the 18-terminal detachable screw terminal connector.

### Attaching the NI WSN-3282 DIN Rail (Optional)

You can mount the NI WSN-3202 on a standard 35 mm DIN rail using a NI WSN-3282 DIN rail clip, NI part number 781074-01. Complete the following steps to mount the NI WSN-3202 on a DIN rail:

**Caution**
Power off the device before mounting it to the DIN rail.

**Note**
Use thread-forming screws to permanently affix the DIN rail clip to the device. Unscrewing and reinstalling the thread-forming screws will produce a compromised connection between the DIN rail clip and the device.

1. Fasten the DIN rail clip to the NI WSN-3202 using a number 2 Phillips screwdriver and the four 8-32 × 5/16 in. thread-forming screws that shipped with the DIN rail clip. Figure 5 shows how to fasten the DIN rail clip to the NI WSN-3202.

**Caution**
Do not use screws longer than 5/16 in. to fasten the DIN rail clip to the NI WSN-3202.
2. Insert one edge of the DIN rail into the deeper opening of the DIN rail clip, as shown in Figure 6.

3. Press down firmly on the NI WSN-3202 to compress the spring until the clip locks into place on the DIN rail.
Using a Panel Mount Accessory

The NI WSN-3280/3281 panel mount accessories, part numbers 780999-01 and 781073-01, each include a retention clip and knob and integrated strain relief for power and I/O wires. You can use the NI WSN-3280 panel mount accessory to attach the NI WSN-3202 device to a panel or other flat surface. The NI WSN-3281 panel mount accessory also includes a magnetic mount for attaching the NI WSN-3202 device to metallic surfaces. Figure 7 shows the NI WSN-3202 panel mounting dimensions.

Figure 7. NI WSN-3202 Device Panel Mount Dimensions
Refer to Figure 8 while completing the following steps to mount the NI WSN-3202 on a panel:

1. **(NI WSN-3280)** Bolt or screw the panel mount accessory to a panel using five 8-32 or M4 screws. **(NI WSN-3281)** Attach the panel mount accessory using the integrated magnet.

2. Slide the NI WSN-3202 device into the panel mount accessory as shown in Figure 8.
3. Slide the retention clip down and tighten the panel mount knob to secure the NI WSN-3202 device as shown in Figure 9.

4. (Optional) Secure any I/O signal or power supply cabling to the panel mount accessory using a zip-tie and the integrated strain relief slots.
Using the Integrated Panel Mount Slots

You can also mount the NI WSN-3202 to a panel using the integrated panel mount slots as shown in Figure 10.

1. Attach three number 8 or M4 pan head screws in the mounting panel, leaving 0.1 in. space under the head of each screw. Refer to Figure 3 for the correct hole pattern and dimensions.
2. Slide the NI WSN-3202 device onto the panel.

Note  In this configuration, the NI WSN-3202 is held in place only by the weight of the device and the screw attachment friction. Use the DIN rail clip or panel mount accessories in high vibration environments.

Caution  Disconnect power before removing the device from the panel.

Setting Up the NI WSN-3202 Device

The following sections discuss setting up the NI WSN-3202 for use.

Installing the Software

You must be an Administrator to install NI software and devices on your computer. Before connecting the hardware, install the following software in the following order:

1. NI LabVIEW, available at ni.com/support.
2. NI-WSN and NI MAX, which are included on the software installation disc included with your NI WSN gateway and are also available for download at ni.com/support.

Note  After installation of NI-WSN, the NI Wireless Sensor Network Getting Started Guide is available from Start> All Programs> National Instruments> NI-WSN.
Powering the NI WSN-3202 Device

The NI WSN-3202 device can be powered on by either an external power supply or four AA alkaline batteries. Refer to the Specifications section for details about the input power and battery requirements.

If both battery and external power are connected, the NI WSN-3202 functions from the external power input. The device is designed to provide battery backup in the event of loss of external power and will automatically switch to battery power when external power is lost.

Installing Batteries

To install batteries in the NI WSN-3202 device, complete the following steps:

1. Loosen the battery compartment retention screw and remove the compartment cover, as shown in Figure 11.

![Figure 11. NI WSN-3202 Battery Compartment](image)

1 Battery Retention Screw

Caution Using the incorrect battery type causes an explosion risk. Do not use rechargeable batteries. Refer to the Battery Replacement and Disposal section for information about how to dispose of used batteries.

Note When using the NI WSN-3202 device on battery power, you should configure the device as an end node so that it sleeps most of the time. Running a device configured in router mode from battery power greatly reduces the battery life. The device ships from the factory configured as an end node. For more information about how to switch the node from end mode to router mode, refer to Configuring WSN in MAX, available from Start»All Programs»National Instruments»NI-WSN.
2. Install four AA alkaline batteries in to the device, making sure to install them with the correct polarity. Figure 13 shows the battery polarity markings inside the device battery compartment.

3. Reinstall the battery compartment cover and tighten the retention screw.

Connecting External Power to the NI WSN-3202 Device

To connect an external power supply to the NI WSN-3202, complete the following steps:

1. Remove the 2-position mini-combicon plug from the device, loosening the retaining screws if necessary.

![2-Position Mini-Combicon Plug](image)

Figure 12. 2-Position Mini-Combicon Plug

2. Connect the external power supply positive lead to the V terminal.
3. Connect the negative (common) lead to the C terminal.
4. Reinstall the 2-position mini-combicon plug in the device and tighten the retaining screws.

**Caution** You must use a UL Listed ITE power supply marked LPS with the NI WSN-3202. The power supply must also meet any safety and compliance requirements for the country of use.
Device Interface

Figure 13 shows the NI WSN-3202 device interface.

1. WSN Connect Button
2. Signal Strength/Status LEDs
3. User LED
4. 9–30 V External Power Input
5. Reset Button
6. Battery Slots/Polarity Indicators
7. I/O Connector
8. Antenna

Figure 13. NI WSN-3202 Node Interface
AXIS P13 Network Camera Series
Superb image quality for video surveillance in any environment.

AXIS P13 Network Camera Series comprises of indoor and outdoor-ready fixed cameras that deliver superb image quality with H.264 compression and are ideal for high-performance surveillance in any indoor or outdoor environment. The megapixel models also deliver HDTV 720p/1080p video.

AXIS P13 Series offers cameras supporting a range of resolutions up to 5-megapixel with AXIS P1347 and AXIS P1347-E cameras. Models are available in both indoor and "-E" outdoor-ready versions. The cameras provide wide dynamic range, and day and night functionality for superb image quality in daylight and dark conditions.

The 3- and 5-megapixel cameras also offer the unique and revolutionary P-Iris control, which allows the cameras to precisely control the iris position to optimize depth of field and lens resolution for optimal image sharpness.

All AXIS P13 cameras deliver multiple H.264 and Motion JPEG video streams. H.264 greatly reduces bandwidth and storage needs without compromising image quality.

The SVGA and megapixel models have a remote back focus function that enables the focus to be fine-tuned from a computer. The same models also offer digital pan/tilt/zoom, and the 3- and 5-megapixel cameras additionally provide multi-view streaming.

AXIS P13 cameras support Power over Ethernet (PoE) for easy installation. The outdoor-ready models operate using PoE and High PoE in temperatures from -40 °C to 50 °C (-40 °F to 122 °F).
**High-performance indoor/outdoor cameras**

AXIS P13 Series offers fixed network cameras suitable for a range of video surveillance applications, including government and industrial buildings, retail environments, airports, railway stations and schools.

**Easy installation with focus assistant, remote focus and pixel counter**

Setting the focus on all AXIS P13 cameras is made easy with the focus assistant, which indicates with a flashing green LED when an image is in focus after manually adjusting the lens. Additionally, the SVGA and megapixel models offer remote back focus, which allows the focus to be fine-tuned from a computer. The pixel counter further helps the installer verify that the pixel resolution of an object fulfills regulatory or customer requirements, for example, for facial identification.

**Outdoor-ready models**

AXIS P13-E Network Cameras save installation time and costs since they are ready out of the box for mounting outdoors. The IP66-rated cameras have protection against dust, rain, snow and sunlight, and can operate in temperatures as low as -40 ºC (-40 ºF). The cameras are powered by Power over Ethernet, which makes installation easy since there is no need for a separate power cable. An integrated dehumidifying membrane eliminates any humidity caught in the camera enclosure during installation. The cameras enable easy mounting of an infrared illuminator under the enclosure. They come with a wall mount bracket, sunshield and cable glands.

**Digital PTZ and multi-view streaming**

The SVGA and megapixel camera models support digital pan/tilt/zoom, which allows a selected area of interest to be cropped from the full view for viewing or recording, thereby minimizing the bit rate and storage needs. The 3- and 5-megapixel cameras also support multi-view streaming, which allows several cropped view areas to be streamed simultaneously, simulating up to eight virtual cameras.

**Multi-view streaming with AXIS P1346/-E and AXIS P1347/-E Network Cameras**

![Multi-view streaming diagram](image)

One camera  
Full overview enabling cropped view areas  
Multiple virtual camera views (up to eight views possible)

**P-Iris control**

The 3-megapixel AXIS P1346/-E and the 5-megapixel AXIS P1347/-E cameras feature a new and advanced precise iris control, P-Iris, that sets new image quality standards for fixed cameras. It comprises a special P-Iris lens together with specialized software in the camera to enable the camera to set the best iris position for optimal image contrast, clarity, resolution, and depth of field. Having good depth of field—where objects at different distances from the camera are in focus simultaneously—allows more of a scene to be clearly visible.

P-Iris is especially beneficial for megapixel cameras as it can help the cameras maintain the delivery of crisp, high-resolution images, even in difficult lighting situations. P-Iris uses the same type of connector and cable as the traditional DC-iris control, which is also supported by the 3- and 5-megapixel cameras for backward compatibility.

For more on P-Iris and iris controls, go to: www.axis.com/corporate/corp/tech_papers.htm
## Technical Specifications – AXIS P13 Network Camera Series

### Camera

| Models: indoor | AXIS P1343: SVGA resolution, day and night |
| AXIS P1344: 1 MP/HDTV 720p, day and night |
| AXIS P1346: 3 MP/HDTV 1080p, day and night |
| AXIS P1347: 5 MP, day and night |

| Models: outdoor | AXIS P1343-E: SVGA resolution, day and night |
| AXIS P1344-E: 1 MP/HDTV 720p, day and night |
| AXIS P1346-E: 3 MP/HDTV 1080p, day and night |
| AXIS P1347-E: 5 MP, day and night |

### Image sensor

| AXIS P1343/-E: Progressive scan RGB CMOS 1/4" |
| AXIS P1344/-E: Progressive scan RGB CMOS 1/4" |
| AXIS P1346/-E: Progressive scan RGB CMOS 1/3" (effective) |
| AXIS P1347/-E: Progressive scan RGB CMOS 1/2.7" |

### Lens

All AXIS P13 cameras use IR-corrected, CS-mount lens.

### Video

#### Video compression

| H.264 (MPEG-4 Part 10) | Motion JPEG |

#### Resolutions

| AXIS P1343/-E: 800x600 (SVGA) to 160x90 |
| AXIS P1344/-E: 1280x800* (1 MP) to 160x90 |
| AXIS P1346/-E: 2048x1536 (3 MP) to 160x90 |
| AXIS P1347/-E: 2560x1920 (5 MP) to 160x90 |

#### Frame rate

| H.264/Motion JPEG |

#### Motion JPEG

30 fps in all resolutions.

#### Video streaming

Multiple, individually configurable streams in H.264 and Motion JPEG.

#### Multi-view streaming

Up to 8 individually cropped out view areas.

#### Pan/Tilt/Zoom

Digital PTZ, preset positions, guard tour.

#### Image settings

Compression, color, brightness, sharpness, contrast, white balance, exposure control, exposure zones, backlight compensation, fine tuning of behavior at low light, rotation, mirroring of images, wide dynamic range – dynamic contrast.

Text and image overlay, privacy mask.

### Audio

#### Audio streaming

Two-way.

#### Audio compression

AAC LC 8/16 kHz, G.711 PCM 8 kHz, G.726 ADPCM 8 kHz.

#### Audio input/output

External microphone input or line input, line output.

### Network

#### Security

Password protection, IP address filtering, digest authentication, HTTPS encryption**, IEEE 802.1X network access control**, user access log.

#### Supported protocols

IPv4/IPv6, HTTP, HTTPS**, QoS Layer 3 DiffServ, FTP, SMTP, Bonjour, UPnP*, SNMPv1/v2c/v3(MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS.

#### System integration

##### Application

Open API for software integration, including VAPIX® and AXIS Camera Application Platform.

##### Programming Interface


AXIS Video Hosting System (AVHS) with One-Click Camera connection.

##### Intelligent video

Video motion detection, active tampering alarm, audio detection.

Support for AXIS Camera Application Platform enabling installation of additional applications.

##### Event triggers

Intelligent video, external input.

#### Event actions

File upload via FTP, HTTP and email; notification via email, HTTP and TCP; external output activation; video and audio recording to edge storage; pre- and post-alarm video buffering.

#### Installation aids

Focus assistant, pixel counter, remote back focus.

#### General

##### Casing

Camera: Metal (zinc)。

AXIS P1343/P1344/P1346/P1347:

EN 55022, EN 55024, EN 60950-1, EN 61000-6-1, EN 61000-6-2, EN 61000-3-2, EN 61000-3-3.

C-tick AS/NZS CISPR 22, ICES-003 Class B, IEC 60529 IP66, NEMA 4X-rated, IK10 impact-resistant aluminum enclosure with integrated dehumidifying membrane.

Color: white NCS S 1002-B.

##### Processor and memory

AXIS P1343/-E, AXIS P1344/-E:

ARTPEC-3, 800 MHz, 128 MB Flash.

AXIS P1343/-E/P1344/-E/P1346/-E/P1347/-E:

ARTPEC-3, 256 MB RAM, 128 MB Flash.

AXIS P1343/E/P1344/E/P1346/E/P1347/E:

IEEE 802.3af, 256 MB Flash.

AXIS P1343/P1344/P1346/P1347:

B-20 V DC or Power over Ethernet (PoE) IEEE 802.3af.

AXIS P1343/P1344/P1346/P1347:

Max. 6.4 W, PoE Class 2.

AXIS P1346: 9.6 W, PoE Class 3.

AXIS P1347: Max. 9.0 W, PoE Class 3.

AXIS P1343/-E/P1344/-E/P1346/-E/P1347/-E: PoE IEEE 802.3af.

Max. 12.95 W or High PoE max 25.5 W.

##### Connectors

RJ-45 10BASE-T/100BASE-TX PoE, 3.5 mm mic/line in, 3.5 mm line out; terminal blocks for power, 1 alarm input and 1 output.

##### Edge storage

SD/SDHC memory card slot (card not included).

Support for recording to network share (network-attached storage or file server) - available in firmware version 5.40 and up.

##### Operating conditions

AXIS P1343/P1344/P1346/P1347:

Humidity 20 - 80% RH (non-condensing), 0°C to 50°C (32°F to 122°F).

AXIS P1343/P1344/P1346/P1347:

-30°C to 5°C (-22°F to 122°F) with PoE; down to -40°C (-40°F) with High PoE.

##### Approvals

EN 55022; EN 55024; EN 60601-1; EN 61000-6-1; EN 61000-6-2; FCC Part 15 Subpart B Class B, VCCI Class B, C-tick AS/NZS CISPR 22, ECES-003 Class B.

##### Weight

AXIS P1343/P1344/P1346/P1347: 0.6 kg (1.3 lb).

AXIS P1343/-E/P1344/-E/P1346/-E/P1347/-E: 3.1 kg (6.8 lb).

##### Included accessories


AXIS P1343/P1344/P1346/P1347: Wall mount bracket, sunshield, cable glands.


---

** This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (www.openssl.org)
Technical Specifications – AXIS P13 Network Camera Series

Dimensions: AXIS P13 Network Cameras

Dimensions: AXIS P13–E Network Cameras and wall mount bracket with internal cable channel

Optional accessories

AXIS PoE Midspan 1-port
AXIS T8123 High PoE 30 W Midspan 1-port

AXIS T90A Illuminators
Lenses
AXIS T8414 Installation Display

For information on AXIS Camera Station and video management software from Axis’ Application Development Partners, see www.axis.com/products/video/software/

Optional mounting accessories for outdoor models

Wall bracket accessories

Adapter plate
Pole mount
Corner mount

Ceiling brackets with ball joint
Column mount with ball joint

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GSM SIM300/900

GSM/GPRS RS232 Modem is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serial port. The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. This GSM/GPRS RS232 Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface.

The modem needed only 3 wires (Tx, Rx, GND) except Power supply to interface with microcontroller/Host PC. The built in Low Dropout Linear voltage regulator allows you to connect wide range of unregulated power supply (4.2V -13V). Yes, 5 V is in between!! Using this modem, you will be able to send & Read SMS, connect to internet via GPRS through simple AT commands.

Features:

- High Quality Product (Not hobby grade)
- Quad-Band GSM/GPRS
- 850/ 900/ 1800/ 1900 MHz
- Built in RS232 Level Converter (MAX3232)
- Configurable baud rate
- SMA connector with GSM L Type Antenna.
- Built in SIM Card holder.
- Built in Network Status LED
- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
- Audio interface Connector
- Most Status & Controlling Pins are available at Connector
- Normal operation temperature: -20 °C to +55 °C
- Input Voltage: 5V-12V DC
Specifications:
- Quad-Band 850/ 900/ 1800/ 1900 MHz
- GPRS multi-slot class 10/8
- GPRS mobile station class B
- Compliant to GSM phase 2/2+
  - Class 4 (2 W @850/ 900 MHz)
  - Class 1 (1 W @ 1800/1900MHz)
- Dimensions: 24*24*3mm
- Weight: 3.4g
- Control via AT commands (GSM 07.07,07.05 and SIMCOM enhanced AT Commands)
- Low power consumption: 1.0mA(sleep mode)
- Operation temperature: -40°C to +85 °C

Specifications for Fax
- Group 3, class 1

Specifications for Data
- GPRS class 10: max. 85.6 kbps (downlink)
- PBCCH support
- Coding schemes CS 1, 2, 3, 4
- CSD up to 14.4 kbps
- USSD
- Non transparent mode
- PPP-stack

Specifications for SMS via GSM/GPRS
- Point to point MO and MT
- SMS cell broadcast
- Text and PDU mode

Software features
- 0710 MUX protocol
- embedded TCP/UDP protocol
- FTP/HTTP

Special firmware
- MMS
- Java (cooperate with isolation)
- Embedded AT
Specifications for Voice

- Tricodec
  - Half rate (HR)
  - Full rate (FR)
  - Enhanced Full rate (EFR)
- Hands-free operation
- (Echo suppression)
- AMR
  - Half rate (HR)
  - Full rate (FR)

Interfaces

- Analog audio interface pins at 2mm Pitch RMC
- RS232 Serial interface
- SMA Antenna Connector
- DC Power pins at 2mm Pitch RMC

Compatibility

- AT cellular command interface

Operating Conditions:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>IN/OUT</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage Vin</td>
<td>Input</td>
<td>4.2</td>
<td>13</td>
<td>V</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>--</td>
<td>40</td>
<td>590</td>
<td>mA</td>
</tr>
</tbody>
</table>
Operating Modes:
The table below briefly summarizes the various operating modes referred to in the following chapters.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Operation</td>
<td><strong>GSM/GPRS SLEEP</strong></td>
</tr>
<tr>
<td></td>
<td>Modem will automatically go into SLEEP mode if DTR is set to high level and there is no on air and no hardware interrupt (such as data on serial Port). In this case, the current consumption of GSM Modem will reduce to the minimal Level. In SLEEP mode, the Modem can still receive paging message and SMS from the system normally.</td>
</tr>
<tr>
<td>GSM IDLE</td>
<td>Software is active. Modem has registered to the GSM network, and the Modem is ready to send and receive.</td>
</tr>
<tr>
<td>GSM TALK</td>
<td>Connection between two subscribers is in progress. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.</td>
</tr>
<tr>
<td>GPRS STANDBY</td>
<td>Modem is ready for GPRS data transfer, but no data is currently sent or received. In this case, power consumption depends on network settings and GPRS configuration.</td>
</tr>
<tr>
<td>GPRS DATA</td>
<td>There is GPRS data transfer (PPP or TCP or UDP) in progress. In this case, power consumption is related with network settings (e.g. power control level), uplink / downlink data rates and GPRS configuration (e.g. used multi-slot settings).</td>
</tr>
<tr>
<td>POWER DOWN</td>
<td>Normal shutdown by sending the “AT+CPOWD=1” command or using the PWRKEY. The power management ASIC disconnects the power supply from the baseband part of the GSM Modem. Software is not active. The serial port is not accessible. Operating voltage remains applied to the internal circuitry</td>
</tr>
<tr>
<td>Minimum functionality mode (without removing power supply)</td>
<td>Use the “AT+CFUN” command can set the modem to a minimum functionality mode Without remove the power supply. In this case, the RF part of the modem will not work or the SIM card will not be accessible, or both RF part and SIM card will be closed, and the serial port is still accessible. The power consumption in this case is very low.</td>
</tr>
</tbody>
</table>
1.3 Turn off GSM Modem Using AT Command
You can use the AT command “AT+CPOWD=1” to turn off the modem. This command lets the GSM Modem log off from the network and allows the GSM Modem to enter into a secure state and save data before completely disconnecting the power supply. Before the completion of the switching off procedure the GSM Modem will send out result code:
“NORMAL POWER DOWN”

After this moment, the AT commands can’t be executed. The GSM Modem enters the POWER DOWN mode, only the RTC is still active. POWER DOWN can also be indicated by STATUS pin, which is a low level voltage in this mode.

1.5 Power Saving:
There are two methods for the GSM Modem to enter into low current consumption status. “AT+CFUN” is used to set GSM Modem into minimum functionality mode and DTR hardware interface signal can be used to lead system to be in SLEEP mode (or slow clocking mode).

1.6 Minimum Functionality Mode:
Minimum functionality mode reduces the functionality of the GSM Modem to a minimum and, thus, minimizes the current consumption to the lowest level. This mode is set with the AT+CFUN” command which provides the choice of the functionality levels <fun>=0 1 4
• 0: minimum functionality;
• 1: full functionality (default);
• 4: disable phone both transmit and receive RF circuits;

If GSM MODEM has been set to minimum functionality by “AT+CFUN=0”, the RF function and SIM card function will be closed. In this case, the serial port is still accessible, but all AT commands correlative with RF function or SIM card function will not be accessible.

If GSM MODEM has been set by “AT+CFUN=4”, the RF function will be closed, the serial port is still active. In this case all AT commands correlative with RF function will not be accessible.

After GSM MODEM has been set by “AT+CFUN=0” or “AT+CFUN=4”, it can return to full functionality by “AT+CFUN=1”.

For detailed information about “AT+CFUN”, please refer to document [1].

1.7 Sleep Mode (Slow Clock Mode):
We can control SIM900 GSM Modem to enter or exit the SLEEP mode in customer applications through DTR signal. When DTR is in high level and there is no on air and hardware interrupt
(such as GPIO interrupt or data on serial port), GSM MODEM will enter SLEEP mode automatically. In this mode, GSM MODEM can still receive paging or SMS from network but the serial port is not accessible.

**Note:** For GSM MODEM, it requests to set AT command “AT+CSCLK=1” to enable the sleep mode; the default value is 0, that can’t make the GSM Modem enter sleep mode. For more details please refer to our AT command list.

### 1.8 Wake Up GSM MODEM from SLEEP Mode:

When GSM MODEM is in SLEEP mode, the following methods can wake up the GSM Modem.

- Enable DTR pin to wake up GSM MODEM. If DTR pin is pulled down to a low level this signal will wake up GSM MODEM from power saving mode. The serial port will be active after DTR changed to low level for about 50ms.
- Receiving a voice or data call from network to wake up GSM MODEM.
- Receiving a SMS from network to wake up GSM MODEM.

### 1.9 Summary of State Transitions (except SLEEP mode):

The following figure shows how to proceed from one mode to another.

---

**2.0 Serial Interfaces:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>5</td>
<td>Ground</td>
</tr>
<tr>
<td>CTS</td>
<td>8</td>
<td>Clear to send</td>
</tr>
<tr>
<td>RTS</td>
<td>7</td>
<td>Request to send</td>
</tr>
<tr>
<td>TXD</td>
<td>2</td>
<td>Transmit data</td>
</tr>
<tr>
<td>RXD</td>
<td>3</td>
<td>Receive data</td>
</tr>
</tbody>
</table>

---
The GSM module is designed as a DCE (Data Communication Equipment), following the traditional DCE-DTE (Data Terminal Equipment) connection. The GSM Modem and the client (DTE) are connected through the following signal (as following figure shows). Auto bauding supports baud rate from 1200bps to 57600bps.

Serial port
- TXD: Send data to the RXD signal line of the DTE
- RXD: Receive data from the TXD signal line of the DTE

Serial port of the GSM engine supports auto bauding for the following baud rates: 1200, 2400, 4800, 9600, 19200, 38400 and 57600bps. Factory setting is auto bauding enabled. This gives you the flexibility to put the GSM engine into operation no matter what baud rate your host application is configured to. To take advantage of auto bauding mode, specific attention should be paid to the following requirements:

**Synchronization between DTE and DCE:**

When DCE powers on with the auto bauding enabled, user must first send “A” to synchronize the baud rate. It is recommended to wait 2 to 3 seconds before sending “AT” character. After receiving the “OK” response, DTE and DCE are correctly synchronized. The more information please refer to the AT command “AT+IPR”.

**Restrictions on autobauding operation:**

- The serial port has to be operated at 8 data bits, no parity and 1 stop bit (factory setting).
- The Unsolicited Result Codes like "RDY", "+CFUN: 1" and "+CPIN: READY" are not indicated when you start up the ME while autobauding is enabled. This is due to the fact that the new baud rate is not detected unless DTE and DCE are correctly synchronized as described above.

**Note:** You can use AT+IPR=x to set a fixed baud rate and save the configuration to non-volatile flash memory. After the configuration is saved as fixed baud rate, the Unsolicited Result Codes like "RDY" should be received from the serial port all the time that the GSM MODEM is power on.
**AT Command Syntax**
When DCE powers on with the autobauding enabled, user must first send “A” to synchronize the baud rate. It is recommended to wait 2 to 3 seconds before sending “AT” character. After receiving the “OK” response, DTE and DCE are correctly synchronized. The “AT” or “at” prefix must be set at the beginning of each Command. To terminate a Command line enter <CR>, otherwise known as carriage return or \r.

Commands are followed by a response that includes <CR><LF><response><CR><LF>. Only the responses are presented in the document here, <CR><LF> are omitted intentionally.

Example: With Local Echo enabled:
Transmit: AT\r
Receive: AT\r\n\nOK\n
**SETTINGS FOR EASY MICROCONTROLLER COMMUNICATION**

When communicating with the GSM Modem using a microcontroller, you usually want very short responses, no local echo, and no startup messages.

Sticking on the&W to the end of the command saves the setting into memory.

ATV0&W\r Enable short response
ATE0&W\r Disable Local Echo
AT+CIURC=0;&W\r Disable “CALL READY” Startup Message

Now instead of commands returning OK or ERROR in plain text, as well as repeating all written commands, the GSM Modem will not echo what you transmit and the GSM Modem will return error codes in single bytes. For example, instead of:

Transmit: AT\r
Receive: \n\nOK\n\n
You’ll have:
Transmit: AT\r
Receive: \n\n0\n\n
SAMPLE AT COMMANDS CODE

1. PHONE COMMUNICATION

Goal: Call a phone
Dial 123-456-7890 = ATD1234567890;\r
This command returns OK or ERROR. Returns NO CARRIER when phone hangs up

2. SEND A TEXT MESSAGE

Goal: Send a text
AT+CMGF=1\r
Returns OK or ERROR
AT+CSCS="GSM"\r
Returns OK or ERROR
AT+CSCA="+13123149810" \r
Returns OK or ERROR. This number +13123149810 is the short message center for AT&T/Cingular service. T-Mobile’s is +12063130004
AT+CSMP=17, 167, 0,240\r
Returns OK or ERROR. These numbers refer to settings for text message sending, keep them this way.
AT+CMGS="
AT+CMGS="1234567890"\r
Returns > , prompting what message to send. 1234567890 is the phone number that the text message will be sent to.
Hello this is a message <Ctrl+z>

Type any message, and then press <Ctrl+z>. Returns confirmation message and Message ID number

3. SEND A TEXT MESSAGE

Goal: Read a Text
AT+CMGF=1\r
Returns OK or ERROR
AT+CMGDA="DEL ALL"
Delete all text
AT+CNMI=0, 0
Disable unsolicited error code
AT+CMGR=1
Read Message #1
AT+CMGL="REC UNREAD"
Read all received unread messages
Debug port

- Null modem port
- Only contain Data lines TXD and RXD
- Debug Port used for debugging and upgrading firmware. It cannot be used for CSD call, FAX call. And the Debug port cannot use multiplexing function. It does not support autobauding function.
- Debug port supports the communication rates is 115200bps

2.1 Software Upgrade and Software Debug

The DBG_TXD, DBG_RXD and GND must be connected to the IO connector when user need to upgrade software and debug software, the DBG_TXD, DBG_RXD should be used for software upgrade and for software debugging. The TXD and RXD also should be connected to the IO connector, if user wants to send AT command or data stream to GSM MODEM. The PWRKEY pin is recommended to connect to the IO connector. The user also can add a switch between the PWRKEY and the GND. The PWRKEY should be connected to the GND when GSM MODEM is upgrading software. Please refer to the following figure.
2.2 Audio Interfacing:

<table>
<thead>
<tr>
<th>AIN/OUT</th>
<th>Pin Name</th>
<th>Pin Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIC</td>
<td></td>
<td>1</td>
<td>Microphone1Input+</td>
</tr>
<tr>
<td>GND</td>
<td></td>
<td>2</td>
<td>Common Ground</td>
</tr>
<tr>
<td>SPK</td>
<td></td>
<td>3</td>
<td>Audio Output +</td>
</tr>
</tbody>
</table>

The GSM Modem provides one analog input channel, AIN, which may be used for microphone. The electrets microphone is recommended when the interface is used for microphone. The outputs connect to the receiver. The receiver outputs only can directly drive 32Ω.

External line inputs are available to directly mix or multiplex externally generated analog signals such as Polyphonic tones from an external melody IC or music generated by an FM tuner IC or module. You can use AT+CMIC to adjust the input gain level of microphone, use AT+SIDET to set the side-tone level. In addition, you can also use AT+CLVL to adjust the output gain level. For more details, please refer to document. It is suggested that you adopt one of the following two matching circuits in order to improve audio performance. The difference audio signals have to be layout according to difference signal layout rules. As show in following figures (Note: all components package are 0603.) If you want to adopt an amplifier circuit for audio, we recommend National Company's LM4890. Of course you can select it according to your requirement.
Interfacing the Modem to Microcontroller (Basic connection)

The Modem can be directly interface with 5V microcontrollers like PIC, AVR, 8051 Derivatives, Arduinos and 3V3 Microcontrollers like ARM, ARM Cortex XX etc. Make ensure V_INTERFACE pin is supplied with same voltage level as the microcontroller VCC. As per the Fig: 3 there is only 2 connections are required to use the modem. Connect RX pin of the modem to the TX pin of the microcontroller and TX pin of the modem to microcontroller’s RX pin. The connected power supply (4.2v to 12v dc) should be capable of handling current up to 1 A.

Interfacing the Modem to ARDUINO:
GETTING STARTED

1) Insert SIM card:
   Open the SIM cardholder by sliding it as per the arrow mark and lift up. Insert the SIM card, so as to align the chamfered corner suits in card holder. After inserting the SIM card, lock the holder by sliding it to the opposite direction of arrow mark.

2) Connect The Antenna:
   Fix the Supplied RF antenna to the SMA Antennae connector and tighten it by Rotating the Nut (Never rotate the antennae for tightening).

3) Connect the Pins:
   Connect the GSM modem as per the circuit diagram provided

4) Power the Modem:
   Power the modem from suitable power supply, which is having enough current capacity (>1A).

5) Check the Status of the LEDs:
   - PWR LED - Red LED will lit immediately
   - STS LED - Green LED will lit after 1-2 seconds
   - NET LED -Blue LED will starts to blink in fast for few seconds (Searching for Network) and becomes slow blinking once the Modem registers with the Network.

6) Network LED
   The Network LED indicates the various status of GSM module e.g. Power on, Network registration & GPRS connectivity. When the modem is powered up, the status LED will blink every second. After the Modem registers in the network (takes between 10-60 seconds), LED will blink in step of 3 seconds. At this stage you can start using Modem for your application.

7) Baud rate
   The Baud rate supported by the modem is between 9600 and 115200. Make sure the host system is set to the supported baud rate.

- The modem automatically sets to the baud rate of the first command sent by the host system after it is powered up. User must first send “A” to synchronize the baud rate. It is recommended to wait 2 to 3 seconds before sending “AT” character. After receiving the “OK” response, Your Device and GSM Modem are correctly synchronized. So there is no need for setting the baud rate using commands.

- Before You Start using the modem, please make sure that the SIM card you inserted support the needed features and there is enough balance in SIM!
Testing with a PC:

1. Connect the GSM Modem to a PC COM Port
2. Create a HyperTerminal (Windows tool for serial port communications) window with Baud rate 9600 and connect it to the COM Port to which GSM is connected.
3. Type any AT command in the HyperTerminal window and you could see the modem responding by sending “OK”.

TERMINAL WINDOW ON PC WHERE GSM MODEM IS CONNECTED

SAMPLE CODE – FOR INTERFACING WITH MICROCONTROLLER
/* this program module sends an SMS from the modem to a prefixed number */
void main()
{
    SerialPortInit();       /* Serial Communication – 9600-N-8-1 */
    Send2Gsm("AT\r\n");    /* Transmit AT to the module – GSM Modem sends OK */
    DelayS(2);       /* 2 sec delay */
    Send2Gsm("ATE0\r\n");      /* Echo Off */
    DelayS(2);       /* 2 sec delay */
    Send2Gsm("AT+CMGF=1\r\n");     /* Switch to text mode */
    DelayS(2);       /* 2 sec delay */
    Send2Gsm("AT+CMGS="+91988575203"\r\n");  /* Send SMS to a cell number */
    DelayS(2);       /* 2 sec delay */
    Send2Gsm("TEST DATA FROM INNOVATE");  /* Input SMS Data */
    SerialTx(0x1a);       /* Ctrl-Z indicates end of SMS */
    DelayS(2);       /* 2 sec delay */
    while(1);
}

Function Description

SerialPortInit – Module to initialize serial communication parameters
Send2Gsm – Module to transmit a string of data through Serial Port
SerialTx – Module to transmit a byte through serial port