**Solinst Telemetry System**

The STS enables 2-way communication and control between a central computer based station and field located Leveloggers, Barologgers and Rain Loggers. Communication may utilize cellular GSM, CDMA, AMPS, landline telephone or radio.

STS Systems are designed to allow the user to save time and money by automated remote collection and self-management of data. The STS is so easy to operate and understand that it can be completely set up by the user.

The STS and its software are suitable for both small and large systems. The Central Computer System (CCS) can run up to six modems and each modem can run up to 100 Remote Telemetry Units (RTUs). The System can also be operated on a laptop. Password protection for three levels of access authority, as well as high and low water level alarm warnings are available.

**Long-Term Cost Savings**

Financial savings provided by the STS come primarily from time saved through automated data collection, and logistic cost savings through the reduction of travel related expenses to access each site for data collection. In many cases, as the costing graph at right depicts, a complete telemetry system can pay for itself over a manually monitored system in 2–3 years. When cost savings can be realized in such a short amortization period, the financial arguments to telemeter long-term or high logistical cost data collection projects become very strong. In addition, the peace-of-mind value of having advance alarm notification and much more frequent access to data.

**Advantages**

- Long term cost savings
- Time saved by eliminating manual data collection
- Frequent and scheduled access to detailed data
- No need to travel to remote field locations
- Self-management gives additional savings and data security
- Simple software and easy network management

**Applications**

- Remote water level monitoring
- Long-term drought monitoring
- Oversight of water taking
- Golf course & mine water management
- Longer term pump tests
- Flood water management
- Long-term aquifer management
- Well data to PLC/SCADA systems

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**Telemetry Costs vs Manual Monitoring Costs**

Based on 25 Leveloggers, 5 Barologgers, 25 RTUs.
Monthly manual download or semi-annual telemetry visit.
Hourly rate $50 (inclusive of all expenses).
**Leveloggers & Barologgers** have a datalogger, 10-year battery, pressure transducer and temperature sensor, all housed in a very small, minimal maintenance, 7/8” x 4.9” (22x125mm) stainless steel housing. The sealed design offers protection against power surges such as nearby pumps or lightning, and greatly simplifies maintenance.

Leveloggers are connected to the surface with direct read cable for rapid downloading of data and/or reprogramming, without removal from the water. No vented cable or desiccants are needed. The inexpensive Barologger is available to provide the most accurate and easy method of barometric compensation.

The key features of Leveloggers and Barologgers with respect to their use in the STS are that they operate on their own user-defined logging schedule, on internal datalogger and operate independently for up to 10 years. The loggers continue to collect data regardless of the status of the RTU.

**Remote Field Equipment**

The STS is designed for use with Leveloggers and the Solinst Rain Logger. The loggers are attached to the wellhead using direct read cables and to the RTUs with armoured cable. A 3-Button Controller, battery, modem, transceiver and terminal panel are all protected within a Nema4 box with a connected antenna. The telemetry controller has a display screen and three buttons to allow viewing of latest readings, RTU time, date and battery level also powering up of the RTU for initial setup, testing and data collection. A low-gain whip antenna is standard, however, hi-gain antennas and solar panels may be used for battery charging.

**Computer Controls**

The STS provides three levels of user access to the remote RTU. The primary access level is via the STS Administrator Software running on the Central Computer System. The Administrator Software controls the telemetry network, to add/remove/edit RTUs, program RTU settings, “ON” times, polling events and alarm condition settings. Most importantly the Administrator Software runs the automated collection of telemetered data. A secondary user software package referred to as the Observer is a password access program that provides users the ability to obtain the last readings or download all the logged data since the last polling event by that observer. It does not allow alteration of any of the RTU or telemetry system settings.
**STS Telemetry Case Study**

The Ontario Ministry of the Environment and Energy required water well monitoring and telemetry equipment, installation services and a central data management system, to be part of the establishment of a Provincial Groundwater Monitoring Network (PGMN).

Under the contract Solinst supplied the Well Monitoring and Telemetry Equipment along with training and technical support for the equipment. Golder Associates managed the project, installing the equipment and supplying the Central Data Management System.

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The contract called for the supply of up to 380 Remote Telemetry Units, utilizing Leveloggers and Barologgers to measure water level, temperature and barometric pressure. These units were installed in 38 Conservation Authorities across the Province of Ontario, Canada.

As of September, 2003, 239 Solinst Telemetry Units, 365 Leveloggers and 28 Barologgers were The Central Data Management System has been in operational mode since July 2001.

Approximately 400 wells across Ontario are being studied. Continuous monitoring helps the government track long-term drought conditions and obtain vital province-wide baseline groundwater information. Telemetry takes the most important function of this project, the data collection, away from the possibility of human error. The Ministry saves valuable time that would have been spent on field visits and accomplishes its monitoring goal while saving taxpayers' money.

**Setting up an STS System**

The STS has easy to use Windows based software with which the user chooses times and selections using pull-down menus. No code writing or knowledge of traditional programming is required. The STS is designed to communicate with one to three loggers per location. This allows any combination of 3: Leveloggers, Barologgers and Rain Loggers for each STS. The loggers are pre-programmed using Levelogger Software with required monitoring regimes and deployed at the remote site using direct read cables.

Modem communication is then established with the Central Computer System (CCS). The dialing schedules are downloaded to the RTU and subsequently communications are established at the chosen scheduled times for receiving data from each Levelogger.

To maintain a low power usage, the RTU is typically programmed by the Administrator Software to turn ON only for short periods, several times per day or week. These ON times are the schedules. The user will select which ON times are to be used as actual data polling events. For instance, the user may program an RTU to power up for 4 minutes, 2 times/day, for use by Observers, or for re-scheduling, etc., but will only poll for data once per week.

**Data Management**

Data retrieved from the each logger is placed in individual .lev files on the computer, appending the newest data onto the existing file. This data can be viewed with the standard Levelogger Software or exported directly into other spreadsheets or databases.

The Observer Software allows a secondary user group access to the data in the RTU, without allowing them to alter schedules, which are controlled only by the Administrator.

**Setting up Dialing Schedules**

The software has a simple system for identifying each individual logger, and allows easy set-up of automatic dialing and polling schedules. It also allows manual dial ups during scheduled “ON” times. A built-in automatic checking system avoids schedule conflicts, using a map of schedule times.

As a precautionary measure, the CCS clock time and the dialing schedule information is downloaded to the RTU at each communication with the CCS. This allows schedules to be changed and avoids possible imbalances in the schedules.
**Power**
The STS 12V DC design uses low power electronics and no power while in standby mode. This enables operation for periods up to 1 year before battery recharge is required depending on frequency of access. Solar panels, for continuous trickle charging, or 110V power supply are an optional extra, if more frequent access is required. Leveloggers have a 10-year Lithium battery.

**Alarms**
The STS allows a high and a low water level alarm point to be established individually for each Levelogger. When an alarm status occurs the RTU will call out to the modem of a separate computer. The user can configure how often the alarm status will be checked; how long the condition has to last before the STS dials out; and options for how often it dials out if not getting a connection. These avoid repeated or continuous alarm calls caused by the water level swinging in and out of alarm status.

**Communication Types**
STS Systems are available for use with cellular systems, using GSM or CDMA digital, AMPS analog, as well landline telephone and spread spectrum radio connections on mixed applications.

**Levelogger Data Input to SCADA Systems**
Solinst has developed Modbus RTU and SDI12 protocol converters to allow the latest reading from the logged Levelogger data to be input to any SCADA PLC unit with a serial port. The connection can be direct to the SCADA PLC or Solinst can supply radio links through a Remote Radio Unit sending the converted signal to a Radio Receiver which connects to the SCADA. The logged water level data stored in each Levelogger can also be accessed by traditional Levelogger methods, if more detailed data is desired, or in case of system failure. (See 3001 and 9100 data sheets.)

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**Specifications**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Direct Line</th>
<th>Radio</th>
<th>GSM &amp; CDMA Digital Cellular</th>
<th>AMPS Analog Cellular</th>
</tr>
</thead>
</table>
| **Advantages** | • Less expensive  
• No cellular charges  
• Reliable telephone system  
• If AC power available, system can be ON at all times. | • No airtime or long distance fees  
• Strong 1 Watt power  
• You control the network | • Less expensive airtime  
• Smaller size & smaller battery | • Widest cellular coverage in parts of North America  
• Powerful 3 Watt transceiver  
• Data transmission is faster than with digital |
| **Disadvantages** | • Restricted to locations near existing phone lines  
• More prone to lightning and electrical surges | • RTU>CCS range limited by trees, buildings, etc.  
• in restricted conditions 3250 ft (1Km)  
• in unrestricted area, with Yagi antenna 63,000 ft (20 Km) | • Less geographic coverage than AMPS in some areas | • AMPS network is being retired to digital networks |
| **Modem** | FCC approved AC/DC integral | FCC approved DC, FCC part 15 Rss-210, spread spectrum | FCC, IC, CE approved | FCC and IC approved |
| **Power** | 12V/12AH sealed lead acid battery | 12V/12AH sealed lead acid battery | 12V/1.3AH sealed lead acid battery or smaller | 12V/12AH sealed lead acid battery |
| **Operational Sales Limits** | -30 to 60°C, 0-99% relative humidity | -30 to + 55°C, 0-99% relative humidity | -30 to + 55°C, 0-99% relative humidity | -30 to 60°C, 0-99% relative humidity |
| **Auto Answer** | 1200-19200 DTE rate, MNP 10 EC Modem Hayes AT Command Set with 400 byte buffer in modem control | 9600 baud | 2400-9600 DTE rate | 1200-19200 DTE rate MNP10 EC Modem Hayes AT Command Set with 400 byte buffer in modem control |
| **Antenna** | None | External Whip | External mini-whip | External ground-planed 3dB whip; loaded coil whip optional |
| **Nema 4X Enclosures** | 12” x 10” x 6 etc. | 7.5” x 3.5” x 3.5” etc. | 7.5”x3.5”x3.5” (19mm x 89mm x 89mm) | 12” x 10” x 6” (305mm x 245mm x 152mm) |

**Optional Equipment /Accessories**

<table>
<thead>
<tr>
<th>Trickle Charge Accessories</th>
<th>Central Computer System Requirements</th>
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</thead>
</table>
| • 4 Watt Solar Panel - suitable for one call per day access  
• 20 Watt Solar Panel, suitable for hourly access  
• AC/DC power - suitable for access anytime. | **Computer**  
• PC Pentium 400 or better, (1GHz or more)  
• Laptop with sufficient screen size and modem port is suitable for up to a maximum of 100 RTUs. |
| **Battery Charger** | **Software**  
• Solinst Levelogger Software  
• Administrator Software  
• Observer Software: for secondary users with limited access optional |
| • 10AH or 1.5AH style, depending on system  
Protective Enclosure |  
• Nema 1 armoured steel box to enclose wellhead manifold, STS Nema 4X box & antenna, allowing easy access for manual readings |