Norges vassdrags- og energidirektorat

NVE

Station for hydrometric measurements
Technical specification

Oslo, 13.06.2013

Index

1.0 Background

Norwegian Water resources and Energy Directorate (NVE) is running a relatively large network of hydrometrical gauging stations. NVE either owns the station itself or operates them on contract, mainly for the energy industry. The majority of NVE's basic hydrometric stations measure water stage in rivers or lakes/reservoirs, water temperature and air temperature. Some stations have more sensors in addition. The acquired data is stored locally, and automatically transferred to NVEs server using telemetry.

This document is the tenders technical specification.

2.0 Environmental requirements

Equipment must tolerate the climatic conditions in Norway,
and must fulfill the specifications regarding functionality and precision:

Equipment must not get damaged if powered on and exposed to:

- Temperature between -50 to +60 ºC
- Humidity between 5 to 95 %

Equipment must fulfill the following operating environmental specifications:

- Logger core functionality;
  (sampling, logging, local storage)
  Temperature between -40 to +50 ºC
- Logger display operation;
  Temperature between -20 to +50 ºC
- Station fully operational;
  Temperature between -30 to +50 ºC
- Logger core functionality,
  Logger display operation,
  Station fully operational;
  Humidity between 5 to 95 %

3.0 Cabinet

Cabinet with logger will be placed both indoor in wooden huts,
and outdoor, inside an outer cabinet.

The following criteria must be fulfilled:

Cabinet:

- Made of non-metallic material, with IP51 or better.
- Maximum cabinet size in cm: 60x40x20.
- An easy method for replacing modules inside cabinet, e.g. DIN-rail mounting.
- Not have any special locker key.

All components/equipment must be contained inside the cabinet, except battery:

- Non-corroding screw terminals mounted for easy access. There must be some space for expansion of terminals.
- Solution for desiccant (silica gel) for two submersible level transmitters with vented cables.
- Cable inlets (with PG nipple) in bottom of the cabinet;
  2x PG13,5, 4x PG11 and additional 2x PG13,5 aligned with the desiccant system.
- Breathing valve for pressure balancing.
- Wiring diagram, laminated, mounted inside on door.

4.0 Power

Normally the source of power will be 12volt battery with charging from solar power.
Equipment should have low power consumption, this is highly focused.

Equipment must fulfill the following criteria that must be documented:

- Have normal operation range of 10-16VDC.
- Average power consumption ≤ 0.25 W.
- The solar power regulator must handle up to 85 watt solar panel and AGM battery, have temperature compensated two step charging and low own power consumption.
- Not get damaged during low voltage- or unstable power conditions and fully operational when starting up after low voltage- or unstable power conditions.

5.0 Standard datalogger technical specifications

Loggers will be used in standard applications where basic hydrological parameters are measured (stage, air temperature, water temperature).

The logger must fulfil the following minimum criteria that must be documented:

- SDI-12: Minimum 16 parameters.
- Logger must be fully SDI-12 v.1.3 compliant.
- Analog. Minimum 6 channels. Supporting Volt-, 4-20mA-, PT100 measurement.
- Analog input resolution ≥ 16 bit.
- Monitoring and logging of external battery voltage (0-16V).
- Support for digital inputs and outputs.
- Software controlled modem switching power.
- Switched power for warm-up time for activating sensors (e.a. 4-20mA and PT100 sensors).
- Communication ports:
    - Minimum 1x RS232 port in addition to the primary communication modem (port).
    - A separate connection for local communication and configuration.
- Integrated display, showing status, date and time, logging interval, instantaneous value and last logged value.
- Internal clock must have the possibility to be set automatic and via the data acquisition system. Specifications regarding clock drift must be documented.
- Configurable, both locally and remotely. It must be possible to do reliable configurations on unreliable data communication lines.
- Be possible to calibrate and set sensor values, date and time directly on logger without PC or other external devices.
- Start up with normal functionality when power is turned on after loss of power.
- Storage: Minimum 15 month of data with 10 minute logging interval @ 4 channels.
- Data values stored in non-volatile memory and be retained even during extended periods without power supply or backup batteries.
- Storage of “rotating” type (FIFO).
- Storage interval, minimum 1 min., set individually for each channel and support both fixed interval and event based storage. Storage capacity must be documented.
- Power: Maximum 50mW @idle.
- Data retrieval;
    - Remote: via telemetry communication.
    - On site: via local connection/communication port.
- Logger terminals must be pluggable.

The logger should fulfil the following criteria that must be documented:

- Have possibilities to log sensor values based on “rate of change”.
- Integrated GSM/GPRS modem

6.0 Telemetry / Remote communication

Primary means of remote communication will be through IP over GPRS/3G. At time of writing, NVE uses *Telenor* as carrier and subscribes to an MDA (*Mobile Data Access)* agreement, operating our own APN and assign static, private IP-addresses to terminals.

The data logger must support push-based data transfer based on a fixed schedule. Data transmission intervals typically range from once an hour to once a day.

The data logger should also support a secondary schedule, activated by certain alarm levels (Rate-of-change or fixed threshold). The device should transmit data at time of alarm, and e.g. every 15. minutes thereafter. The presence or lack of such functionality – or the possibility to implement it – must be stated in the offer.

Remote reconfiguration must also be possible even in push-based mode.

Dial-up data connection with support for data downloading and configuration must also be supported.

The robustness (error-tolerance, error-detection and error-correction) of remote communication – push-based and dial-up – must be described by the supplier.

The GPRS/3G terminal should be an integrated part of the device.

7.0 Data acquisition system

NVE runs and operates all data acquisition systems internally, preferably on virtualized hardware (VMWare enterprise solutions). Preferred OS is Microsoft Windows Server, although other flavors of MS Windows or Linux are acceptable.

NVE prefers SQL server as database platform and the system should support network-based database connections in a robust fashion.

The system must be designed for – and be practically usable with – a large number of stations in a single installation (> 250 locations, >1500 parameters). Theoretical and practical limitations (above or below the figures indicated) must be stated by the supplier.

The system must support both the role as recipient of push-based data transmission and active poll-based acquisition using IP and dial-up connections. In case of dial-up connection, the system must utilize NVEs existing pool of modems, a mix of Wave-com based GSM/GPRS terminals and standard and Hayes-compatible PSTN modems. The modems are attached to two “Moxa NPort 5610” device-servers and each modem is accessible via dedicated, virtual COM-ports or through TCP/IP sockets.

Scheduled polling of stations must be automatically and configuration of schedules, communication medium etc must be group-based, i.e. not on an individual, station-by-station basis.

The system must support automatic clock adjustment of data logger.

The system must support communication with multiple sites in parallel. A complete poll/push sequence to approximately 200 sites must complete in less than 15 minutes assuming IP communication over GPRS and 12 hours of data at each site.

Data entering the system must immediately (i.e delay < 2 minutes) be exported to 3.party system. Preferably, export should be triggered by arrival of new data, alternatively time-scheduled.

Export format must be clearly documented, and preferably in an XML structure. After complete export, system should execute a configurable, 3.party script or program for further processing of the data.

The system must provide a means of low-level inspection of communication between data logger and acquisition system for trouble-shooting purposes. Documentation of the communication protocol used between data logger and acquisition & configuration system must be provided to NVE, either as an open document or based on a confidentiality agreement.

Although NVE performs most data handling and management in a separate Hydrological Information System, simple charting and data inspection must be supported in the supplied system.

At time of writing, NVE uses the following data acquisition systems:

- *Hidacs* (from Scan Matic as, Norway)
- *XConnect* (from Sutron corp., USA)
- *Hydras3* (OTT Hydrometry, Germany)
- *XDQ/Timeview* (from Isodaq Tecnology, UK)
- *PMac* (from Technolog, UK)

Data loggers compatible with one of these might have a reduced implementation cost, but compatibility is not a requirement.