A RELIABLE AND LOW COST SOLUTION TO THE ACQUISITION OF

THE OCEANOGRAPHIC DATA

The Coastal Oceanographic Buoy of Marine Biological Station (MBS) in Piran represents a reliable and low cost solution to the acquisition of the oceanographic data at the Slovenian coast. Apart from measuring equipment it was developed by local engineering companies in Slovenia. The main design objectives were high reliability in harsh marine environment, low cost, low power consumption and use of standard and open (source) solutions wherever possible.

A custom made processing unit of the oceanographic buoy is based on an industry standard microcontroller. It incorporates a Flash ROM storage unit, a power control unit and a communication unit with 8 configurable RS232/RS422 communication ports, which can easily be expanded to 32 ports by simple connection of additional communication units. Most measuring instruments on the market are equipped with such interface. The processing unit also monitors operating conditions such as battery voltage, current consumption, operating temperature and humidity. Standard embedded PC, PLC and other solutions found on the market, which were also considered during development did not meet low power, communication or price requirements. Another point in favour of custom solution from local engineering companies was that similar hardware solutions with the same microcontroller already existed at MBS.

The mayor difficulty that software had to meet was a bunch of different proprietary protocols. Although there exists, for example the NMEA 0183 standard communication protocol for marine electronics equipment, many measuring instruments on the market do not, or only partially support this standard. The software also had to provide a reliable communication protocol between buoy and land station with as high as possible utilization efficiency of the existing 19.2 kbit/s radio link. Other desirable functions or properties consisted of: remote download of new software versions, terminal like access to instruments on the buoy and diagnostics capabilities. To meet all communication requirements a simple ARQ protocol was devised that is based on OSI seven layer ISO standard, but with only three layers: physical, link and application layer implemented. The data acquisition process consists of two phases:
1. Data acquisition and storage of data on Flash ROM unit;
2. Transmission of data to land station where measurements are stored in relational SQL database for further processing.

Data in Flash ROM storage unit are retained until reliable transmission to land station is accomplished. During both phases a terminal like access to instruments that do not take part in automatic data acquisition cycle is possible.

Software on the land station is based on open source software (Linux, MySQL) and is responsible for data reception and insertion of data into MySQL relational database together with basic data quality information. Land station runs client part of communication protocol, while processing unit on the buoy runs server part of the protocol. To change operating parameters of the buoy, to download new software to the processing unit on the buoy, to perform diagnostic tests and to have a terminal like access to instruments a simple and efficient user interface is also integrated into land station software package.

In order to ease further upgrading and development all software was written in high-level languages (C, C++) with only some time critical parts of code in assembly language.
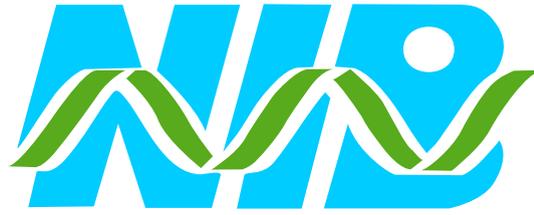
At the end it can be said that the Coastal Oceanographic Buoy installed at Marine Biological Station (MBS) in Piran has achieved its main design objectives:
- reliability,
- scalability,
- low cost,
- low power requirements,
- use of industry and open standards wherever possible and also
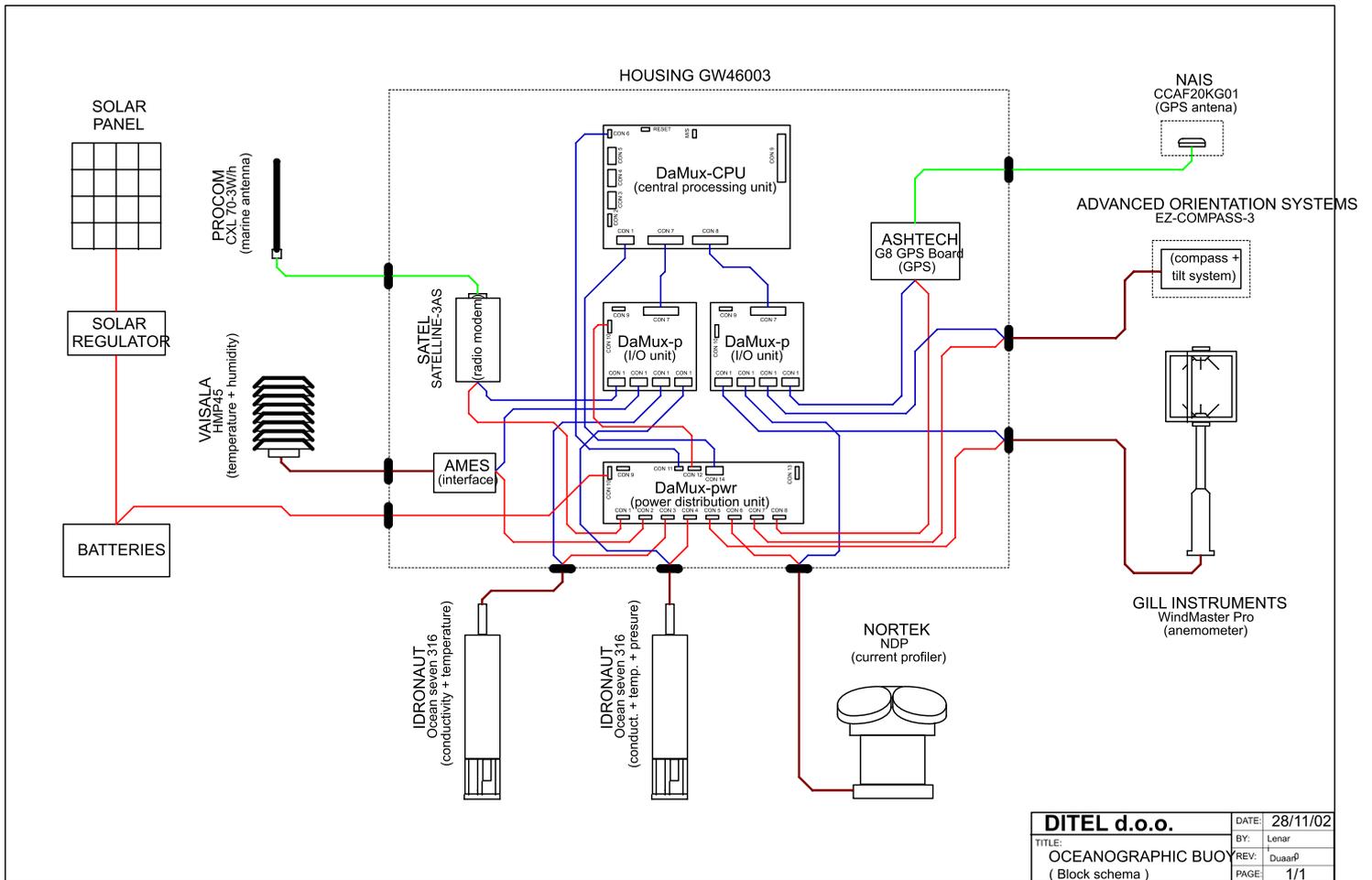- simplicity.

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MORSKA BIOLOŠKA POSTAJA PIRAN
MARINE BIOLOGY STATION PIRAN

HOUSING GW46003

NAIS
CCAF20KG01
(GPS antena)

SOLAR
PANEL

PROCOM
CXL 70-3W/h
(marine antenna)

RESET

CON 6
CON 4
CON 3

DaMux-CPU
(central processing unit)

CON 5

CON 1   CON 7   CON 8

ADVANCED ORIENTATION SYSTEMS
EZ-COMPASS-3

ASHTECH
G8 GPS Board
(GPS)

(compass +
tilt system)

SOLAR
REGULATOR

SATEL
SATELLINE-3AS

(radio modem)

CON 9   CON 7   CON 9   CON 7

DaMux-p
(I/O unit)

DaMux-p
(I/O unit)

CON 1 CON 2 CON 1   CON 1 CON 1

VAISALA
HMP45
(temperature + humidity)

AMES
(interface)

CON 9   CON 11   CON 14   CON 13
CON 12

DaMux-pwr
(power distribution unit)

CON 1 CON 2 CON 3 CON 4 CON 5 CON 6 CON 7 CON 8

BATTERIES

IDRONAUT
Ocean seven 316
(conductivity + temperature)

IDRONAUT
Ocean seven 316
(conduct. + temp. + presure)

NORTEK
NDP
(current profiler)

GILL INSTRUMENTS
WindMaster Pro
(anemometer)

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