# **RTU** and control in the same device



# Should the RTU and the control functionality be in the same unit?

Many water and wastewater pump stations have a separate control device and RTU. This brief paper examines the reasons behind this choice, and especially whether those reasons are historical, or are current practical ones.

## Some of the reasons expressed for separation

In our investigations of some of the larger water and wastewater authorities around the world, we found many organisations in favour of having one integrated control/RTU device. However, there were some who were initially opposed to it for the following reasons:

- We have always done things this way
- The RTU can't reliably handle the complete control algorithm while doing sophisticated DNP3 communications at the same time
- If the unit fails, you have lost everything comms and control

## History

"We have always done things this way"

If everybody were of this opinion no progress would ever be made in technology development or the implementation of new technology.

## **Processing power**

"The RTU can't reliably handle the complete control algorithm while doing sophisticated DNP3 communications at the same time"

This has been a statement expressed by some customers. The real source of this opinion is from various RTU suppliers who have had insufficient power in their host processor units to handle the demands of:

- The sophisticated communications required by the DNP3 protocol
- Modem or radio handling
- I/O monitoring and control
- Complex control algorithms for pump station management

This problem was real, and many RTU based control solutions were found wanting in practice. However, there are products on the market now that can easily demonstrate their ability to handle in one unit:

- DNP3 master and slave
- Modbus master (to interrogate another device such as a VFD)
- I/O control and monitoring
- Up to 9-pump control with complex alternation and pump control logic
- Display driving to give an integrated user interface

One example of a unit with this capability is the MultiSmart pump station manager and RTU. This unit has a combination of high speed processing, built on a reliable embedded operating system that can handle sophisticated memory management and multi-threading of processes. The I/O has a separate processor (technically, a DSP or Digital Signal Processor) to handle high speed capture of all of the I/O.

The MultiSmart can be setup to demonstrate the capability above, with tools available to show that the processor and memory are nowhere near being overloaded.





Figure 1 – MultiSmart IO unit and display

# Redundancy

"If the unit fails, you have lost everything - comms and control"

This statement was expressed by a number of customers. There appear to be three reasons why this statement is made.

- This was the typical separation of products in the past, therefore users have come to work around this setup even though it is not the theoretical optimum
- The RTU is given basic backup control functionality when the control device fails (usually based on level rising to a critical point)
- The problems of re-establishing a station when "all the eggs are in one basket"

#### Typical separation of products

This is another argument made from history. Many system designs were done 20 years ago, when PLCs didn't have good remote comms and RTUs didn't have strong control capability. So system designers and electrical engineers created the optimum redundancy system for this generation of product.

## **Backup functionality**

This is a legitimate requirement for any station – ensuring redundancy of control. However, there are much more cost-effective solutions. For example, the new MTRA-TL backup relay, which has pump control, level alarm and pump fault sensing.

## Fixing a failed station

Users need the ability to re-establish a failed station as quickly as possible, and many integrated products present problems with this requirement.



#### Problems with this approach

The logic of wanting to separate comms and control is not so clear.

For example, why not separate (in a 2-pump station) pump 1 control and pump 2 control? This way if pump 1 control fails, you still have control for pump 2. The division between comms and control is an arbitrary one.

Take a 100 station system with separation of control and comms. There will be 200 devices in the panels. With an MTBF (mean time between failure) of 200,000 hours, you would expect 8 failures per year, or one failure every 6 weeks.

Instead, consider a system with an integrated solution. Now there are 100 devices in the panel, and with a similar MTBF you would expect on average one failure every 12 weeks.

The problem is, with separate controls and comms, when comms fails, you have to send someone to site to find out what is happening, and then the comms device has to be replaced. When control fails, the comms device will report that, so you have to send someone out to fix or replace the control device. In both cases, the station is no better off. The practical result is twice as many failures, and twice as much technical detail to learn in terms of diagnosing and replacing field hardware. So in fact, there is more than twice as much technical work to be done. As most organisations find that technical expertise is a scarce resource, this doesn't make sense.

#### Additional integration costs

The other problem with the separation of control and comms is one more level of integration. Now the tags from the control device have to be extracted by the RTU, and the MTU /SCADA has to be configured to display/trend/alarm on these tags.

This means instead of the SCADA being configured to read, e.g. pump 1 flow rate, pump 1 running status, pump 1 fault status, supply voltage, the RTU has to be configured to read these out of the control device. Then the tags have to be mapped through from the protocol master to the slave which interfaces to the SCADA.

Therefore, each change to the control or monitoring requirements call for twice as much integration work. Sometimes this work has to be done by 2 different parties, increasing the cost probably by 4-5 times.

The practical result, as many organisations have found, is to have a very limited system at the SCADA end. There are minimal remote diagnostics, with the users at the SCADA having information like: level, pump running, pump fault, pump flow rate, mains fail and nothing else. Therefore, operationally, they still have to send out staff to site when problems appear to occur. Therefore, operational costs increase as well.

There are better solutions.



# The MultiSmart solution

The MultiSmart pump station manager and RTU provides users with a fully integrated solution. The product consists of a highly integrated pump control and RTU solution with a clear intuitive display for operators and engineers.

In the event of a unit failure, e.g. due to direct lightning strike, a replacement unit can be installed in a few minutes, with a compact flash card used to replace the configuration from the failed station. A contract electrician can do this replacement with minimal training.

This keeps costs low, and provides a much higher uptime than the separation model allows for.

It also greatly reduces integration cost, because no PLC programming is required. There is no integration of RTU to control device, and when operational staff make changes to the system, SCADA staff can access the new tags.

## Data & controls available at SCADA

MultiSmart has many hundreds of tags that can usefully be employed at the SCADA front end. A few examples are:

- 3-phase voltage supply
- D.C. supply to MultiSmart
- Temperature of the panel
- Control (and status) of auto/off/manual
- Power (kW and kVA)
- Energy (KWHr and kVAHr)
- Flow rates per pump, inflow and total station volume
- Pump efficiency (litres per kWhr or gals per kWHr)
- Insulation resistance of motor windings (and insulation resistance fault)
- 3-phase currents
- Pump fault reset
- Station fault reset
- Many different faults per pump allowing remote reset or the right personnel to be sent to site as required



#### Example - MultiSmart screens

More information and screen shots can be found at <a href="http://www.multitrode.com/products/MultiSmart/overview.cfm">http://www.multitrode.com/products/MultiSmart/overview.cfm</a>



Figure 2 – Main screen, 2-pump station



Figure 3 – Fault screen



Figure 4 – History Screen





Figure 5 – Settings, p1 of 1

