OPUS-RTU Remote Telemetry Unit

General Overview

Introduction

This document describes the standard Opus RTU Remote Telemetry Unit. These units are based on the full-featured proprietary Opus PC6-SQL Telemetry/SCADA/IMS software and represent a new generation of intelligent remote telemetry equipment.

The Opus RTU offers a future proof design that combines the use of 'off the shelf' hardware components and full open connectivity. These intelligent RTU systems can be considered as full-featured miniaturised top-end Telemetry/SCADA/IMS systems. The units are typically based on the very latest miniature embedded PC technology (e.g. the Intel Atom Mini-ITX and Pico-ITX motherboards); each unit is capable of operating as a combined RTU, data concentrator, data filter, data logger, and if required a HMI platform.

Pico-ITX (51 x 178 x 165mm) and Mini-ITX (62 x 192 x 210mm and 65 x 300 x 273mm) RTU Cases

The Opus RTU design is based on open access and open connectivity making the units ideally suited to third-party system integrators or end-users who prefer to be independent of the system supplier. All of the RTU's software components are Microsoft Windows compatible and based on the standard field-proven Opus PC6-SQL Telemetry/SCADA/IMS Master Station software. The RTU's computer hardware and I/O interfaces are also based on standard 'off the shelf' items that can be purchased from numerous sources. For example, the Mini-ITX motherboards can be purchased at local computer equipment stores or via numerous Internet companies.

The Opus RTU includes high-performance communications software and supports standard open protocols (Opus TCMP2, Modbus/TCP etc.) allowing the units to be easily integrated into the user's telemetry systems with minimal effort and fuss. The supplied RTUQUERY program and software library allows data to be acquired from the RTUs without any special knowledge of the underlying communication protocols or handling of networked links.

Software Licensing

The standard software license groups and classes are graded to support different sizes of master station or RTU database; the three main license groups are RTU, Entry Level, and Main System.

The standard RTU licence groups support databases ranging in size from 5 stations and/or 250 telemetry points up to a maximum of 5 stations and/or 5000 telemetry points.

The standard 'Entry Level' licence groups support databases ranging in size from 10 stations and/or 250 telemetry points up to a maximum of 25 stations and/or 5000 telemetry points.

The standard Main System licence groups support databases ranging in size from 50 stations and/or 6000 telemetry points up to 1,600 stations and/or 16,000 telemetry points, an additional SM7 license class allows an unrestricted database configuration.

The same identical software is supplied for all of the above license groups. This software provides the same full-featured Telemetry/SCADA/IMS package; each system equipped with Local/Remote Admin workstation interfaces, integrated SQL based Information Management System, the sophisticated OpusIMS web interface, printing facilities, management report generation and general point processing facilities, alarm reporting facilities and the very latest Advanced Graphic Workstation software.
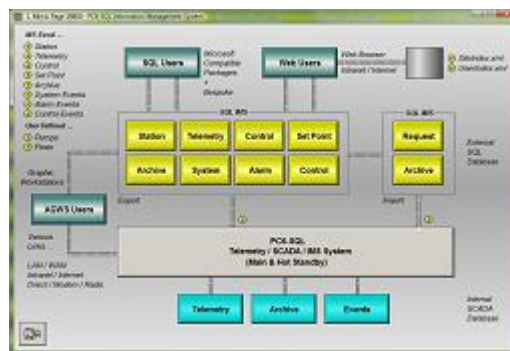
PC6-SQL Main Components

Standard software options are available to support various hot-standby systems, warm-standby or fully on-line Secondary Control Centres (Secondary Master Stations), File Server and NAS (Network Aware Storage) devices, separate SQL/Web Servers, Workstation File Servers (providing a central repository for workstation and user files), and Workstation Servers (accommodating larger numbers of workstation users accessing the system).
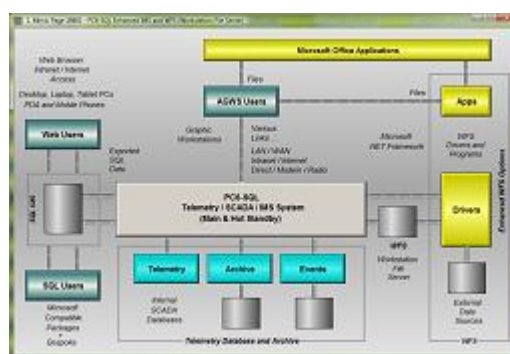
PC6-SQL Workstation File Server

All 'Entry Level' and 'Main System' licenses come with a single workstation user license; this workstation may be activated on the host computer system or installed on a local/remote computer system. Additional user licenses are available to upgrade these systems to support a practically unlimited number of workstation users.

No workstation user license is included in the basic RTU licence although a single user can be supported. These systems do support the Local Admin and Remote Admin workstation links (see

below) which can be used to assist reconfiguration, monitoring, maintenance and system administration.

In addition, any RTU license can be upgraded to ELS or SM grade to support practically any number of workstation connections the client desires. These workstation links can be used to support either HMI displays equipped with touch-screen displays or normal keyboard/mouse driven operator, engineer or management workstations.

Hardware Components

The RTU software can be installed on any Windows 7 Professional based computer system. The RTU software is typically installed on systems based on small footprint embedded PC platforms using the latest Mini-ITX and Pico-ITX form factors. One option is the industry standard Intel Atom Dual Core Mini-ITX motherboard. These energy efficient motherboards are designed to support the needs of modern day Internet-centric computing and have become the standard processor of choice for both home entertainment and industrial embedded PC systems.

Intel Atom Dual Core 1.66GHz Mini-ITX Motherboard

The Mini-ITX form factor is ideally suited for RTU systems. Our miniature low-cost RTU computer system employs a 2.5-inch solid-state disk drive as a bootable drive, holding all essential operating system files and which is also used for data logging, recording all active system data (e.g. archives, system logs, management reports etc.). This solid-state drive along with the use of Mini-ITX motherboards provides the highest possible hardware reliability, designed for '24/7' (once on always on) operation.

Solid State Drive Options

Unless an operator workstation or integrated HMI is required, RTU systems are usually supplied without any display, keyboard or mouse interface. For on-site work, a wide variety of portable LCD screens and interfaces such as the IBM Travel keyboard and mouse pad are available for site engineers to connect to the RTU. Alternatively, the Remote Admin Workstation or Microsoft's Remote Desktop interface can be used to connect an engineer's laptop to the RTU via an Ethernet or WIFI connection.

Remote Admin using Workstation

IBM Travel Keyboard and Mouse Pad

RTUs typically interface to the plant via local or remote devices such as PLCs or Ethernet I/O devices. Various types of I/O interfaces are available to support all manner of input and output configurations (e.g. ADAM, ACROMAG, IOLOGIC etc.). I/O modules may be used as either separate DIN rail mounted units connected via an Ethernet LAN or a Wireless link, or installed in one or more multi-slot units.
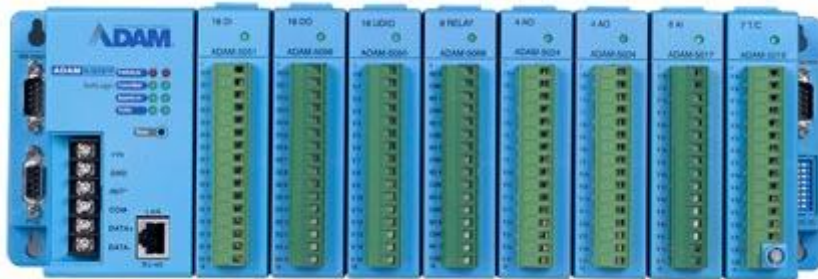
ADAM-5000/TCP 8-Slot I/O Unit

All Opus RTUs can also be used as data concentrators, collecting telemetry and archive data from various other local devices and remote systems (e.g. RTUs, PLCs, outstations, data loggers etc.).

Open Connectivity - Acquiring Data From The RTU

There are numerous ways in which data can be acquired from the RTU. The most common methods of acquiring data from the RTU are,

- Via the open Opus TCMP2 protocol.
- Via an alternative protocol such as Modbus/TCP.
- Using the supplied RTUQUERY utility program.
- Using the supplied RTUQUERY API (Application Program Interface).
- Accessing the data directly from the exported SQL databases.

All communications between Opus RTU systems, sub-master stations and top-end master stations, including the supplied RTUQUERY utility software, uses the standard Opus TCMP2 Telemetry Communications Protocol. Opus TCMP2 is an efficient and secure binary data protocol used for both polling and alarm reporting between telemetry units.

Opus TCMP2 is an open protocol, fully documented with advice to developers who wish to communicate directly with the RTUs and integrate support for TCMP2 based systems into their own products. Other protocols such as Modbus/TCP can also be provided.

The RTUQUERY utility program and user interface provides the means to query and extract data from any Opus system without any knowledge of the underlying protocols and handling of networked connections. If required, this process can be automated through the use of simple script

files to form part of a more extensive data acquisition system. All data resulting from a query is returned in a standard CSV form ready for importing into the user's database or spreadsheets.

The RTUQUERY API (Application Programming Interface) allows those with a certain level of software expertise to integrate the query facilities into their own programs. Again no knowledge is required of the underlying protocols and handling of the network connections.

All Opus systems are capable of exporting the telemetry and archived data into SQL database files. The standard software provides support for Microsoft Sql Server databases and the universal MDB (Microsoft Office Access Database) file formats. RTU systems usually export all relevant telemetry and archive data into MDB database files. The content of these files is fully documented on the system and can be accessed directly by the user.

RTU Data Acquisition

As standard, all RTU systems support the Opus TCMP, TCMP2, Modbus/ASCII, Modbus/RTU, Modbus/TCP and Rockwell (Allan Bradley) DF1 protocols. The licensed Rockwell (Allan Bradley) RsLinx OPC interface is also supported.

These protocols allow the RTUs to communicate with other Opus sub-systems (master stations or RTUs), virtually all makes of PLC and virtually all types of remote I/O device (e.g. the various Ethernet I/O and Wireless I/O modules). Other PLC, Outstation, Data Logger and device protocols can also be supplied on request.

Alarm Reporting

All RTU systems are supplied with the sophisticated Pager software. This software is capable of forwarding 'out of hours' or 'time-expired' unacknowledged alarms to one or more duty officers and/or reporting centres. Alarm messages can be reported using multiple methods including via pagers, text SMS, voice SMS, email or fax.

Data Concentration

All RTU systems are based on the fully-featured Opus PC6-SQL Telemetry/SCADA/IMS software package; these units are quite capable of acquiring data from numerous local and remote sources and thereby acting as miniaturised top-end or sub-systems. The RTU systems are therefore ideally suited to acting as data concentrators or intelligent hubs within the client's overall telemetry scheme.

Data Filtering

All RTUs include extensive data filtering facilities, generally configured within the unit's database. A General Point Processor (GPP) program is provided to process, combine and manipulate the telemetry point data, producing the required 'pseudo' data for the top-end system. Individual telemetry point data (digital status, analogue values and totalised counts) can also be duplicated directly from the source stations (raw plant data) into separate filtered stations ready for data acquisition and reporting to the centralised system(s).

Point archives (or trend data) relating to the filtered data can also be selected individually for data acquisition. Other archive data, logging either the raw plant data or filtered data, can be maintained locally and remain on the RTU. This data can be accessed and analysed via a local/remote operator workstation or Admin workstation link as and when the need arises.

Data Logging

The RTU provides extensive data logging facilities, including individual periodic point archives (trends), individual time-stamped point archives (trends) and event archives (SOE, Sequence Of Event data).

Archive data can be sampled locally by the RTU or acquired from other devices, outstations or PLCs. All logged data can be individually selected for data acquisition; other archive data can be left on the local RTU for analysis via a workstation link as and when required.

The RTU maintains a local history relating to all the telemetry point data (digital status, analogue values and totalised counts). This data can be accessed and analysed in an identical fashion to the time-stamped point archive data via the standard workstation or Admin links.

The RTU also maintains detailed statistical data relating to the inbound and outbound data acquisition and alarm reporting channels, general access logs, communication logs, reconfiguration logs and management reports. Once again this data can be accessed via the standard workstation or Admin links.
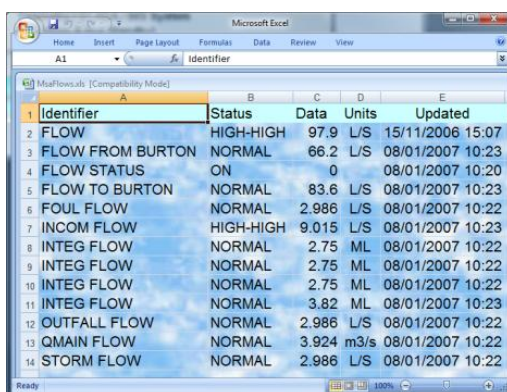
Data Export

The SQL database tables form the heart of an extensive Information Management System (OpusIMS) that is maintained in real-time by the standard PC6-SQL software.

Separate database tables are maintained to store data related to Stations, Telemetry points, Digital Control Points, Analogue Set-Point Controls, System Events, Alarm Events, Control Events, Archive Data Files, and the actual sampled Point Archive data. The size and extent of the SQL database is configurable, determined by the configuration within the 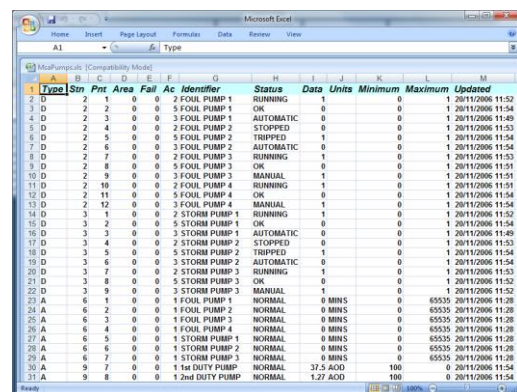master station (or RTU) database. Individual point archives and time-stamped point archives can be selected for data export, the SQL data being stored in either a single Archive database file or separated into individual Archive Data files.

Separate import tables are also provided as a conduit for privileged SQL and Web users to submit requests (controls, set-points etc.) or import new or modified telemetry data back into the system.

Microsoft Excel SQL Data Access   **Data Export to Microsoft Access Files**

All PC6-SQL systems provide support for both Microsoft Access and Microsoft Sql Server database formats. Most systems, including RTUs, use the universal MDB (Microsoft Office Access) file format to maintain the SQL databases. This format provides the most cost-effective solution; the Microsoft Office or Microsoft Access software does not have to be installed for the SQL data to be exported.
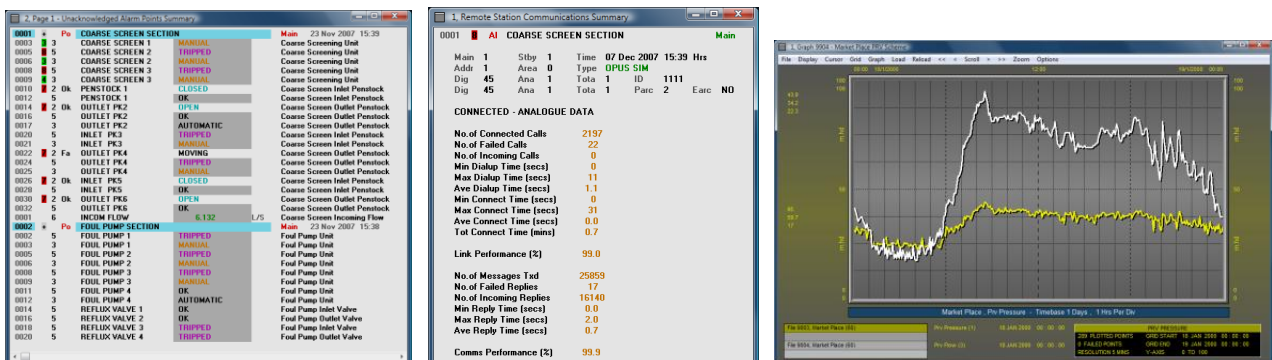
Admin Workstations

All Opus systems support both Local and Remote Admin workstation links. When activated, these links combined with the unlicensed AGWS6 Advanced Graphic Workstation software, provide an extremely useful and versatile connection to all RTU and other Opus systems.

The Admin workstation links provide a non-mimic time-limited connection to all RTU and Opus sites. Mimic and map page displays are not available when using the workstation in this mode, however, all other workstation facilities and displays are available. This includes graph plotting of archive and historic data, real-time trace analysis, all text based displays, all diagnostic displays such as port and process monitoring, utilities such as file access and transfer, database reconfiguration etc.

Both Local and Remote Admin workstation connections provide a totally secure link to an RTU site. These links assist the system administrator or engineer in performing general reconfiguration, system monitoring, maintenance and fault-diagnosis. The remote link can also be used to provide remote support for the system.

The Local Admin workstation connection can be activated with a simple mouse click via either a local interface (display, keyboard and mouse attached to the RTU) or via an engineer's laptop computer acting as a Remote Desktop via a LAN or Wireless connection.

The Remote Admin workstation interface can be permanently enabled and provides secure remote access to the RTU (or other Opus systems) via a standard workstation link. The Admin workstation typically connects to an RTU via a broadband Internet link; however, all forms of asynchronous communications link are supported. The Remote Admin workstation link can also be used locally at the RTU either by connecting to the RTUs Ethernet LAN or by establishing a connection via a Wireless link.

Local and Remote Diagnostics and Administration

Workstation Users

All Opus systems, including RTUs, can be upgraded to support practically any size of database and any number of workstation users. The full-graphic workstation user options are available to provide support for integrated HMI displays, remote HMI displays, and local or remote operator workstations. These user options supplement the unlicensed Local and Remote Admin time-limited non-mimic interfaces that are provided free of charge and used for system administration, configuration and fault diagnosis.

Full Graphic Workstation

Web Interface

The OpusIMS web Interface provides browser access to the system via a local or wide area intranet or the global Internet. This interface allows the system's current telemetry and archive data to be viewed using standard browser software running on mobile devices such as laptops, PDAs, Blackberries, mobile phones, or any office/home PC that has access to the corporate intranet or global Internet.

OpusIMS Web Interface

The web interface supports both large screen and small screen devices. Live data reports can be accessed and displayed on small screen devices such as Blackberries and mobile phones. Alternatively, the current exported SQL database data, which normally resides on the RTUs internal drives, can be queried and data displayed on larger screen devices, such as mobile laptops and PCs.

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