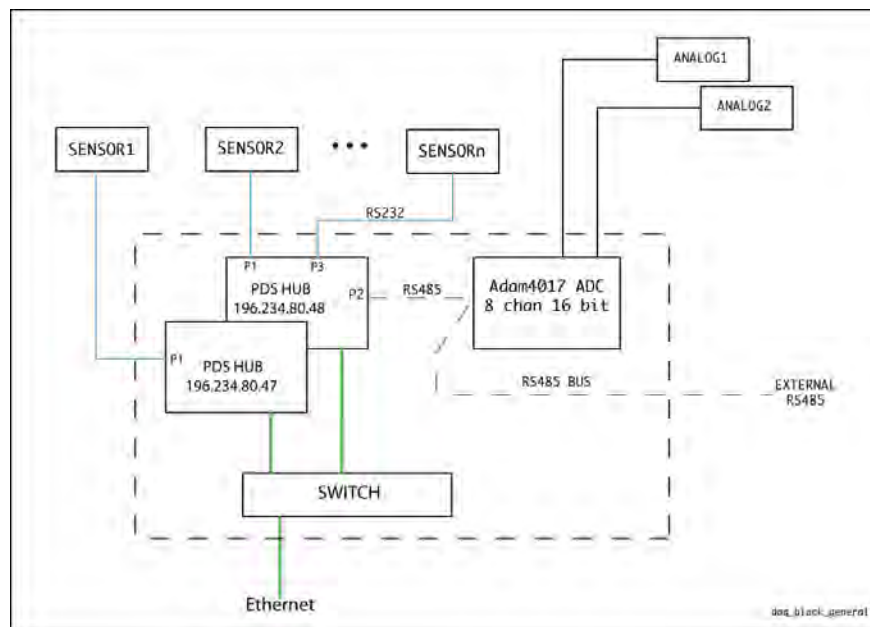

The Modular Architecture of RMR Co. DAQ Instrumentation

SUMMARY

This document describes the electronic hardware used in Data Acquisition interface (DAQ) made by RMR Co.. The design is ethernet TCP/IP based, low power, modular, small, economical and off-the-shelf.



What is the DAQ architecture? Over the past several years the DAQ interface system has been developed and deployed in shipboard applications. The DAQ system provides a completely flexible and expandable interface to analog or serial instrumentation. The key component of the DAQ system is a serial-to-ethernet hub. Through the hub one has a single point of access to a large number of components. In this way a single program can collect data from any number of sensors, digital or analog.

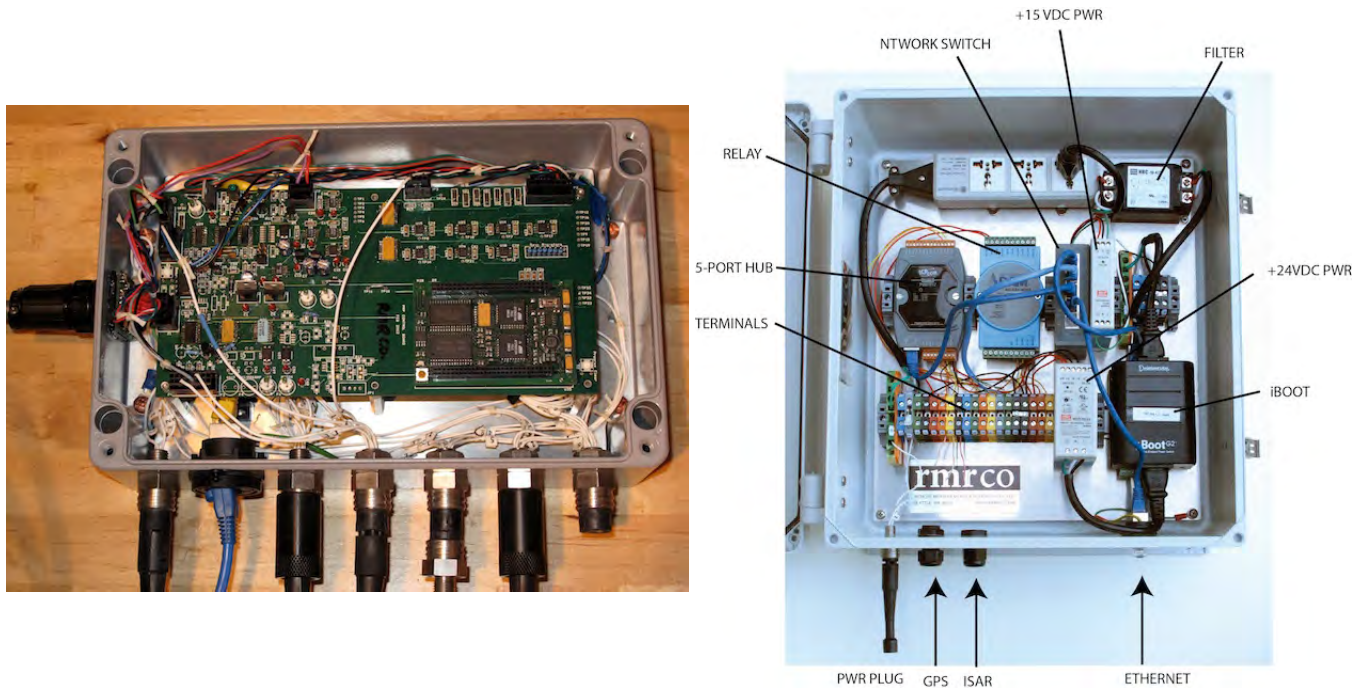
What is the serial-to-ethernet hub? The “hub” takes the serial outputs from modern sensors such as GPS, Tilt sensor, FRSR, and RAD and makes them available on a single ethernet TCP/IP connection. Current DAQ implementations use the **ICP PDS-752(D)**. This device has four serial RS232 and one RS485 connections. If all the four serial ports are occupied one has two options. Either (1) use a network switch to add a second hub or (2) install a different hub model such as the the **PDS-782(D)** which has three additional serial inputs.

How is the RS485 port used? On the ICP hubs, port 2 is dedicated to a **RS485 network**. RS485 devices are addressable and connected by daisy chain into a multidrop network. Special purpose modules for analog-

to-digital conversion, power relay, and digital I/O can be connected onto the RS485 chain. Thus a single multitasking computer (Unix/Linux) can have complete control of an entire system.

What is the DAQ modular software? For the past several years a script-based software package has been developed for the PRP and other equipment used by RMR Co. The Expect-Perl-Kermit package is described on page 3.

INSTRUMENTS USING THE DAQ ARCHITECTURE



PRP: Above are two examples of instruments that use the DAQ architecture. The PRP data unit (left) is a simple enclosure with the Fast Rotating Shadowmand Radiometer (FRSR) circuit board and PDS752, 5-port, hub located under the board. The serial RS232 from other components of the Portable Radiation Package (RAD, GPS and TCM(tilt)) connect directly to the hub.

Note, a design plan (M1107) to integrate a Delta-T SPN-1 radiometer to the PRP involves (1) Adding an Adam4017 analog-to-digital converter next to the hub under the FRSR board and (2) Bringing in the SPN-1 analog lines through the spare connector on the right above. The actual wiring would be straight forward with the ADC connected to Port 2 of the hub, RS485. No machining or hardware changes are necessary.

DAQ4: The right photo shows a more complex system that is installed on the foremast of the Japanese ship R/V *MIRAI*. This system has the same switch-hub arrangement with a network-controlled power system. A RS485 power relay module controls DC power to external instruments. Both of these systems are completely weatherproof. Note the modules used in the DAQ can be mounted on DIN rails. This makes for an easily re-configured assembly.

DAQ MODULAR SOFTWARE

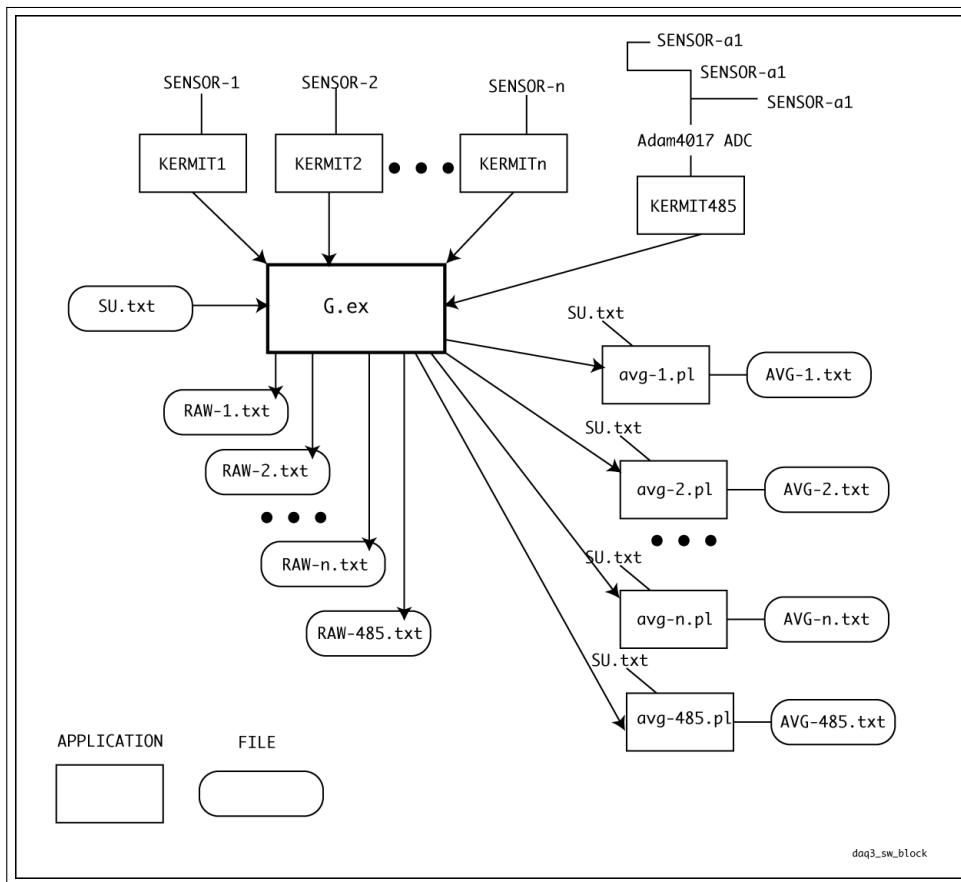


Figure 1: A generic block diagram of the DAQ software.

The core of the software is “G.ex” a program written in the Expect language. Read more [here](#). “Expect is a Unix automation and testing tool, written by Don Libes as an extension to the Tcl scripting language, for interactive applications such as telnet, ftp, passwd, fsck, rlogin, tip, ssh, and others. It uses Unix pseudo terminals to wrap up subprocesses transparently, allowing the automation of arbitrary applications that are accessed over a terminal.”

Serial in/out ports are set up using the “Kermit” software package that was developed at Columbia University. Kermit ports can set up as TCP/IP, ordinary serial, modem, or any of several interface types. The Network Hub has 4 (or seven) serial RS232 ports and one RS485 port. The RS485 connection can address modules on a 485 network. Thus the possible input network is virtually limitless. A setup file, “su.txt” defines all the input sensors and any necessary processing parameters.

G keeps track of each input port. When a data string comes in it is appended to file “RAW-i.txt” with a time stamp. The raw string is then sent to be processed by the corresponding application “AVG-i.txt” which produces statistical averages and any derived variables. The output from these programs are appended to the output files “AVG-i.txt”. Other languages than Perl can be used for the “AVG-i” processing programs. Fortran, C, and Python can be included in the DAQ software suite and the “G” Expect program will “spawn” them. A wonderful benefit of this approach is that any of the processing programs can be developed and tested completely off line the simply introduced via G.ex.



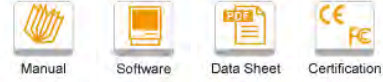
Model: PDS-752(D)
 -NEW- Model: PPDS-752(D)-MTCP



-NEW- Model: PDSM-752(D)
 -NEW- Model: PPDSM-752(D)-MTCP

PDS(M)-752(D) PPDS(M)-752(D)-MTCP

Programmable Serial-to-Ethernet Device Servers



Introduction

The PDS-700 series is a family of Programmable Device Servers, also known as "Serial-to-Ethernet gateway", that are designed for linking RS-232/422/485 devices to an Ethernet network. The user-friendly VxComm Driver/Utility allows users to easily turn the built-in COM ports of the PDS-700 series into standard COM ports on a PC. By virtue of its protocol independence, a small-core OS and high flexibility, the PDS-700 series is able to meet the demands of every network-enabled application.

The PDS-700 series includes a powerful and reliable Xserver programming structure that allows you to design your robust Ethernet applications in one day. The built-in, high-performance MiniOS7 boots the PDS-700 up in just one second and gives you fastest responses.

The PPDS-700-MTCP series features true IEEE 802.3af-compliant (classification, Class 1) Power over Ethernet (PoE) using a standard category 5 Ethernet cable to receive power from a PoE switch like the NS-205PSE. The PPDS-700-MTCP also works as a Modbus TCP to RTU/ASCII gateway that supports most SCADA/HMI communications based on the Modbus/TCP protocol. The PDSM-700 is the PDS-700 with Metal Case (RoHS) and the PPDSM-700-MTCP is the PPDS-700-MTCP with Metal Case (RoHS). Metal Case version includes stronger protection than PDS-700 and PPDS-700-MTCP.

The PDS(M)-752(D) and PPDS(M)-752(D)-MTCP is equipped with 4 RS-232 ports and 1 RS-485 port. The removable on-board terminal block connector is designed for easy and robust wiring in industrial situations.

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Features

- Incorporate Serial Devices in an Ethernet network
- "Virtual COM" Extend COM Ports
- Virtual COM on Windows NT 4.0, 2000/XP/2003 and Vista32
- Powerful Programmable Device Server
- Watchdog Timer suitable for use in harsh environments
- Power Reverse Polarity Protection
- Serial Port +/-4 kV ESD Protection Circuit
- Self-Tuner ASIC Controller on the RS-485 Port
- 5-digit LED Display (for versions with a display)
- RoHS Compliant with no Halogen
- Built-in High Performance MiniOS7 from ICP DAS
- 10/100 Base-TX Ethernet, RJ-45 Port (Auto-negotiating, auto MDI/MDI-X, LED indicator)
- ODM Service Is Available
- Low power consumption
- Palm-Sized with multiple Serial Ports
- Made from fire retardant materials (UL94-V0 Level)

[PPDS(M)-752(D)-MTCP only]

- Supports Modbus TCP to RTU/ASCII Gateway
- Supports PoE (IEEE 802.3af, Class 1)

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Applications

- Factory Automation
- Building Automation
- Home Automation

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Specifications

Models	PDS(M)-752(D)	PPDS(M)-752(D)-MTCP
CPU		
CPU	80186-80 MHz or compatible	
SRAM	512 KB	
Flash Memory	Flash ROM: 512 KB ; Erase unit is one sector (64 KB) ; 100,000 erase/write cycles	
EEPROM	16 KB; Data retention: 40 years; 1,000,000 erase/write cycles.	
Built-in Watchdog Timer	Yes	
Communication Interface		
	COM1	RS-232 (TxD, RxD, RTS, CTS, GND)
	COM2	RS-485 (D2+, D2-, GND)
Non-isolated	COM3	RS-232 (TxD, RxD, RTS, CTS, GND)
	COM4	RS-232 (TxD, RxD, RTS, CTS, GND)
	COM5	RS-232 (TxD, RxD, RTS, CTS, GND)
Ethernet	10/100 Base-TX, RJ-45 port (Auto-negotiating, auto MDI/MDI-X, LED indicator)	
PoE	-	IEEE 802.3af
COM Port Formats		
Data Bit	7, 8: for COM1 and COM2 5, 6, 7, 8: for COM3 ~ COM5	
Parity	None, Even, Odd, Mark, Space	
Stop Bit	1, 2: for COM1 ~ COM5	
Baud Rate	115200 bps Max.	
LED Indicators		
5-digit 7 Segment	Yes, only for "D" versions	
System	-	Red
PoE	-	Green
Power		
Protection	Power Reverse Polarity Protection	
Required Supply Voltage	+10 Vdc ~ +30 Vdc (non-regulated)	PoE or +12 Vdc ~ +48 Vdc (non-regulated)
Power Consumption	PDS(M)-752: 2.0 W PDS(M)-752D: 2.7 W	PPDS(M)-752-MTCP: 2.2 W PPDS(M)-752D-MTCP: 2.9 W
Mechanism		
Flammability	Fire Retardant Materials (UL94-V0 Level)	
Dimension (W x H x D)	72 mm x 123 mm x 35 mm (88 mm x 123 mm x 28 mm for "M" versions)	
Installation	DIN-Rail or Wall mounting	
Casing	Fire Retardant Plastic (Metal for "M" versions)	
Environment		
Operating Temperature	-25 ~ +75 °C	
Storage Temperature	-40 ~ +80 °C	
Humidity	5 ~ 90% RH, non-condensing	

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Ordering information

PDS-752 CR	Programmable Device Server with 4 RS-232 ports and 1 RS-485 port (RoHS) Includes One CA-0910Cable
PDSM-752 CR	PDS-752 CR with Metal Case
PDS-752D CR	Programmable Device Server with 4 RS-232 ports, 1 RS-485 port and an LED Display (RoHS) Includes One CA-0910Cable
PDSM-752D CR	PDS-752D CR with Metal Case
PPDS-752-MTCP CR	Programmable Device Server with PoE, Modbus Gateway, 4 RS-232 ports and 1 RS-485 port (RoHS) Includes One CA-0910 Cable

PPDSM-752-MTCP CR	PPDS-752-MTCP CR with Metal Case
PPDS-752D-MTCP CR	Programmable Device Server with PoE, Modbus Gateway, 4 RS-232 ports, 1 RS-485 port and an LED Display (RoHS) Includes One CA-0910 Cable
PPDSM-752D-MTCP CR	PPDS-752D-MTCP CR with Metal Case

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Accessories

GPSU06U-6	24 Vdc/0.25 A, 6 W Power Supply
MDR-20-24 CR	24 Vdc/1 A, 24 W Power Supply with DIN-Rail Mounting
CA-0903	9-Pin Female D-sub and RS-232 connector cable, 30 cm Cable <Pin Assignment>
CA-0910	9-Pin Female D-sub and 3-wire RS-232 cable, 1 M Cable <Pin Assignment>
NS-205 CR	Unmanaged 5-Port Industrial Ethernet Switch (RoHS)
DIN-KA52F-48	48 Vdc/0.52 A, 25 W Power Supply with Din-Rail Mounting
NS-205PSE CR	Unmanaged Ethernet Switch with 4 PoE Ports and 1 RJ-45 Uplink (RoHS)
DN-09-2	I/O Connector Block with DIN-Rail Mounting and two 9-Pin male Header Includes : CA-0915 x 2 (9-pin Male-Female D-sub Cable 1.5 m)
DN-09-2F	I/O Connector Block with DIN-Rail Mounting and two 9-Pin male Header Includes : CA-0910F x 2 (9-pin Female-Female D-sub Cable 1.0 M)

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