



DanPac™ Measurement and Control System

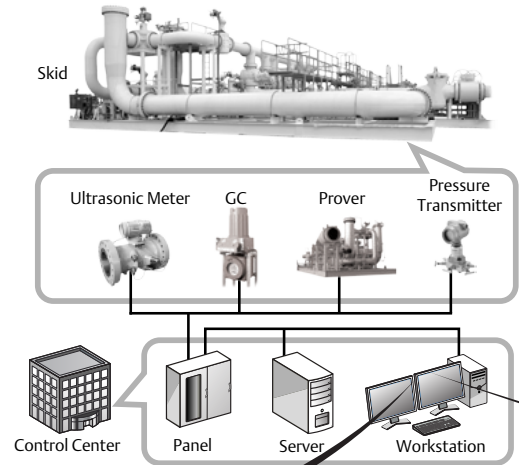
DanPac™ Measurement and Control System

A SMART FISCAL METERING SOLUTION

The Daniel Process Acquisition Controller system known as DanPac provides accurate measurement and unsurpassed control of oil and gas custody transfer and fiscal flow metering installations. Built around Emerson measurement technologies, the DanPac system provides users with multiple meter capability, built-in redundancy and easy integration with a broad variety of DCS hosts and SCADA.

Industries / Applications

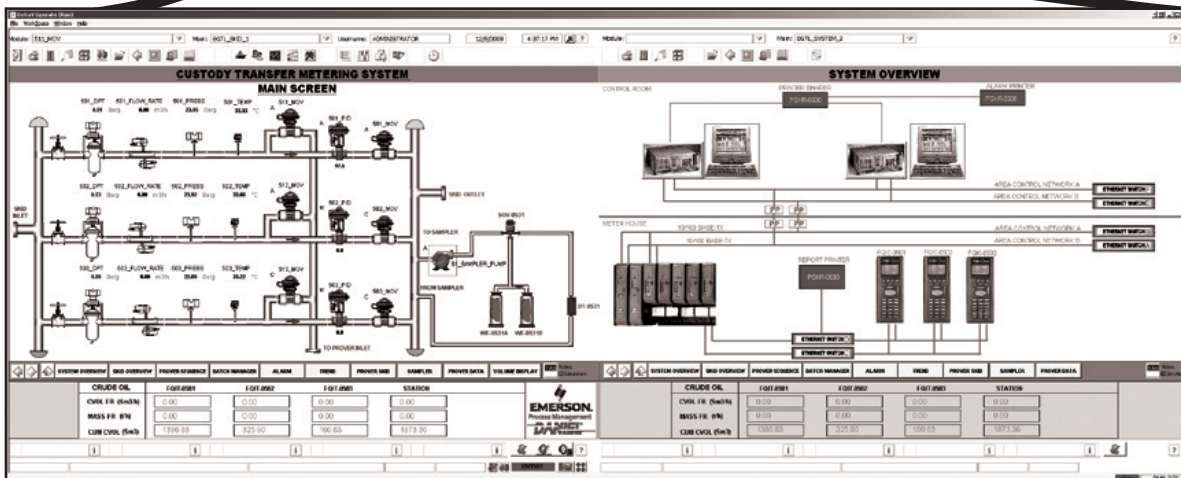
- Custody transfer
- Pipelines
- Refinery
- Off-shore production
- Loading / Off-loading



Typical metering system with DanPac

Features and Benefits

- Single software platform
- Graphical display of metering process monitoring provides information in an easy-to-use format
- Identification of temperature, pressure and flow trends to quickly pinpoint operational anomalies
- Comparison of different meter streams based on temperature, pressure, flow meter factors and repeatability
- Integration of prover sequence flow chart with prove control screens
- Historical process trending helps to alert operators to possible issues on a real-time basis
- Characteristic data for each flow meter can be entered in the system database ensuring individualized high-precision metering
- Quality analysis device data (e.g. analytical devices) can be entered for correction of product delivery information when required
- Important data such as delivery tickets, proving reports, summary reports are archived for future reference
- Standard or optional user-customized reports can be presented to authorities / customers in both printed and electronic format
- DanPac software can communicate with DCS hosts / SCADA to provide metering information on multiple levels (e.g. in refineries or LNG terminals)
- Supports multiple meters, provers and analytical devices



SPECIFICATIONS

Please consult Daniel if your requirements are outside the specifications noted below. Improved performance, other product and material offerings may be available depending on the application. For world area locations and contact information, please refer to the back page of the datasheet.

DanPac System

- **Hardware**

- **Logic Control Panel:**

- MD Plus Controllers
- Virtual I/O Modules: TCP / IP and / or Serial Communication
- Fast Ethernet Switches with RSTP or Hyper Ring

- **Flow Computer Panel:**

- Daniel S600 Flow Computer
- Software for metering and prover calculations

- **Professional Plus Workstation with Operator Login**

- **Optional Operator Workstation**

- **Laser Report Printer**

- **Software**

- **DeltaV system software**

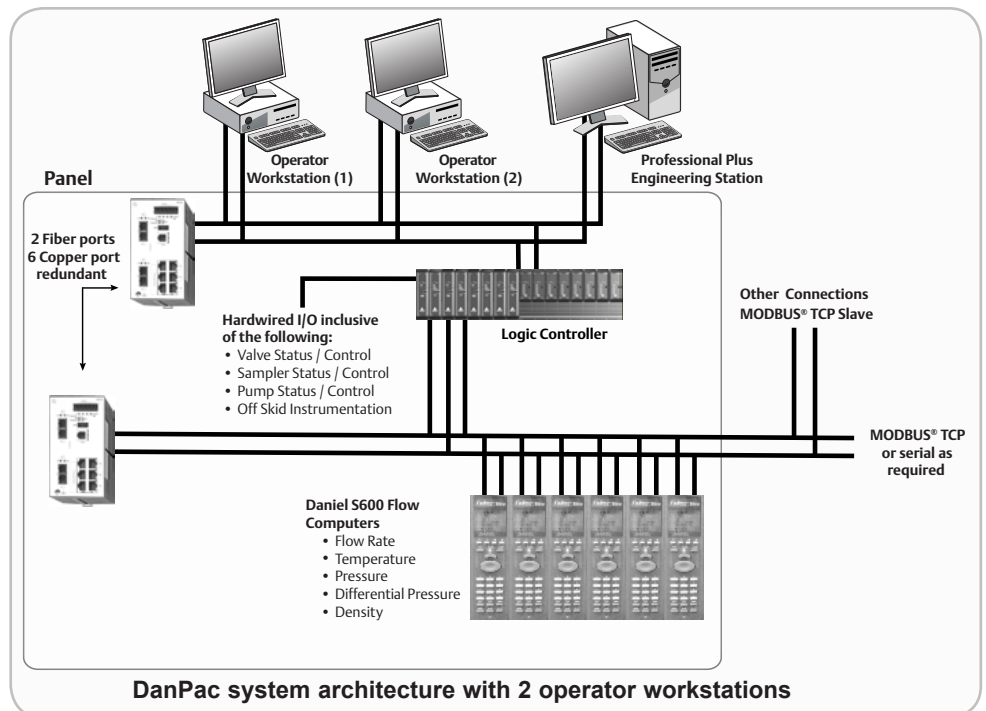
- **Daniel S600 built-in web browsing capability to view live parameters remotely**

- **Operator workstation with Microsoft® Windows XP Professional®**

- **Professional Plus station runs on Windows® 2003 Server**

- **Power Requirements**

- **@120 VAC:** <22 Amps (<2.64 kW)
- **@220 VAC:** <10 Amps (<2.20 kW)

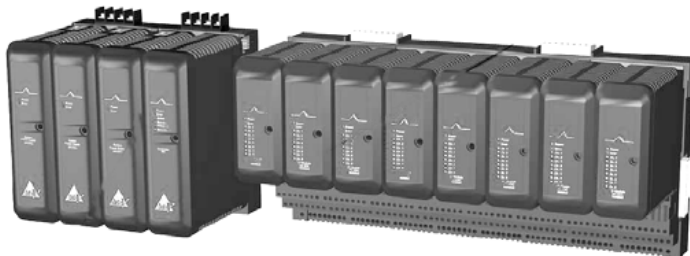


Logic Controller and I/O Subsystem

- MD Plus Controller
- 2-Wide Controller Carriers
- Carrier Mounted Power Supply
- Discrete Input Cards: 32 Channels, 24VDC Dry Contact, 4 to 8 cards
- Discrete Output Cards: 32 Channels, 24VDC High Side, 3 to 6 cards
- Analog Input Card: 8 Channels, 4-20mA HART® (included)
- Environmental
 - Operating Temperature: 0°C to 60°C
 - Storage Temperature: - 40°C to 85°C
 - Relative Humidity: 5 to 95%, non-condensing



Daniel S600
Flow Computer



The I/O subsystem includes redundant power supplies and controllers plugged into 2-wide carriers and I/O cards plugged into an 8-wide carrier

Daniel S600 Flow Computer

- I/O Capability
 - Analog Inputs: 0 to 5.2 V DC or 0 to 22 mA >16 bits
 - Analog Outputs: 0 to 21 mA, 12 bit minimum
 - 4-Wire RTD: PT100 (-100°C to 200°C)
 - Digital Input: 30 V max optically isolated
 - Digital Output: Open Collector, 36 V max, 100 mA
 - Dual Pulse Inputs: DC to 10 KHz, IP252/76, ISO 6551:1996, and API Chapter 5.5 Level A, B or E
 - Pulse Outputs: Open Collector, DC to 100 Hz
 - Prover Pulse Bus: Open Collector, DC to 5 KHz
 - Sphere Switches: Supports 1, 2, or 4 switch mode
 - Frequency Input: DC to 10 KHz, 3 V pk-pk
- Calculations
 - Liquid: API 2540 (Tables 5, 5A, 5B, 5D, 6, 6A, 6B, 6D, 23, 23A, 23B, 23D, 23E, 24, 24A, 24B, 24C, 24D, 24E, 53, 53A, 53B, 54, 54A, 54B, 54C, 54D, 59A, 59B, 60A, 60B), API 11.1, API 11.2.1, API 11.2.1M, API 11.2.2, API 11.2.2M, API 11.2.4, API 12.2.1, API 12.2.1M, API 12.2.2, API 12.2.2M, ASTM D1555-95, GPA TP15, GPA TP15M, GPA TP16, GPA TP25, GPA TP27, Steam & Water IAPSW 1967, NPD, CTSm, CPSm, Solartron / MicroMotion densitometer algorithms, Sarasota / PEEK densitometer algorithms
 - Gas: AGA 3, AGA 5, AGA 7, AGA 8, AGA 10, GPA 2172 & 2145, ISO 5167, ISO 6976, ISO12213 – 2 & 3, GOST 8.563.1 & 2 (97), GOST 8.586, GOST 30319, PR 50.2.019, NX 19, SGERG, VDI/VDE 2040, PTZ, Annubar, V-Cone
 - Prover: Compact, Uni-direction, Bi-direction, Master Meter, Dual Chronometry. Up to 4 sphere switch
- Environmental
 - Operating Temperature: 0°C to 60°C
 - Storage Temperature: - 40°C to 70°C
 - Operating Humidity: To 90%, non-condensing

Virtual I/O Modules

- **Virtual I/O Module Capacity**
 - **Number of Emulated Serial Cards: 4**
 - **Number of Data Sets per Virtual I/O Modules:** 128 (32 per Emulated Card)
 - **Number of TCP / IP Master / Slave or Adapter Nodes per Virtual I/O Modules:** 32 in redundant applications in master mode only, 16 slaves and 16 masters at the same
 - **I/O Card Slot Addressing:** 57 to 60 or 61 to 64 for simplex installation, 57 to 64 for Redundant Pair
- **Environmental**
 - **Operating Temperature:** 0°C to 60°C
 - **Storage Temperature:** - 40°C to 85°C
 - **Operating Humidity:** 5 to 95%, non-condensing



Redundant Virtual I/O Modules providing an Ethernet Network Gateway for a Logic Controller



Hirschmann DanPac switch

Hirschmann® DanPac Switches Software

- **Product Description**
 - **Description:** 8 port Fast Ethernet-switch, programmable managed, for faster communication of data traffic, Software Layer 2 Enhanced, for DIN rail
 - **Ports:** 2 Uplink 100BASE-FX, SM-SC
6 Standard 10 / 100 BASE TX, RJ45
 - **Type:** RS20-0800S2S2EDAHH01.0.
- **Software**
 - **Management:** Serial interface, web-interface, SNMP V1 / V2, HiVision file transfer SW HTTP / TFTP
 - **Diagnostics:** LEDs (power, link status, data, 100 Mbit / s, autonegotiation, full-duplex, error, redundancy management, ring-port, LED test), log-file, syslog, signal contact, RMON (statistics, history, alarm, events), port mirroring, topology discovery 802.1AB
 - **Configuration:** Command line interface (CLI), TELNET, BootP, DHCP, DHCP option 82, HIDiscovery, auto-configuration adapter (ACA21-USB)
 - **Security:** Port security (IP and MAC), SNMP V3 (no encryption)
 - **Redundancy Functions:** HIPER-ring (ring structure), RSTP 802.1w, redundant network/ring coupling, dual homing, redundant 24 V power supply
- **Environmental**
 - **Operating Temperature:** - 40°C to +70°C
 - **Storage Temperature:** - 40°C to +85°C
 - **Operating Humidity:** 10% to 95%, non-condensing



Dell® Power Edge 840 tower server

Professional Plus Engineering Station

• **Hardware**

- **CPU:** Xeon® Dual Core 3050 Processor
2.13GHz, 2MB L2 Cache
- **Memory:** 2GB
- **Drives:** Hard drive: single 73GB
Floppy drive: 1.44MB
DVD-ROM / CDRW Combo drive: 48X
Tape backup unit: PowerVault 100T,
DAT72, 36 / 72GB
- **Monitor:** 20 inch LCD Monitor
- **Video:** Integrated graphics controller with 16MB SDRAM
- **Mouse:** USB Optical (2 button with scroll)
- **Keyboard:** Local USB country
- **Cards:** SAS 5iR controller card
PCI Parallel port card (SIIG)
- **Network:** Redundant control network ports,
three Ethernet ports
- **Options:** Local power cord

• **Software**

- DeltaV software
- Windows Server 2003 OS with SP1 license

• **Environmental**

- **Operating Temperature:** 10°C to 35°C (50°F to 95°F)
- **Storage Temperature:** - 40°C to 65°C (- 40°F to 149°F)
- **Relative Humidity:** 20% to 80% (non-condensing)

• **Chassis Size:**

- **Height:** 17.28" (43.9cm)
- **Width:** 7.80" (19.8cm)
- **Depth:** 19.68" (49.9cm)
- **Weight:** ~ 42.0lbs. (19.0kg)

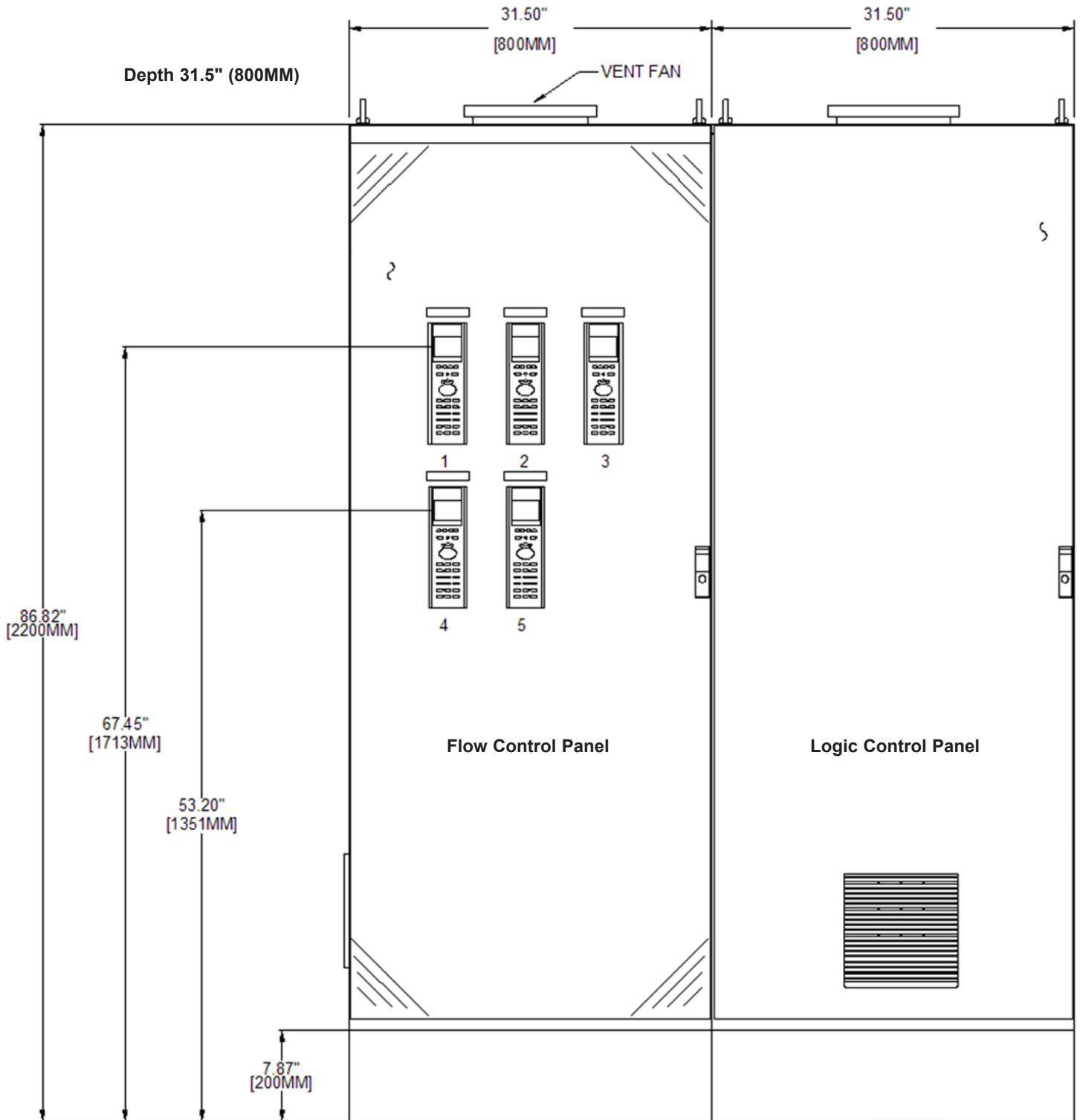


Dell® Precision T3400 mini-tower workstation

Operator Workstation

- **Hardware**
 - **CPU:** Core 2 Duo E6550 Processor
2.33GHz, 4MB L2 Cache
 - **Memory:** 2GB
 - **Drives:** Hard drive: single 73GB
Floppy drive: 1.44MB
DVD-ROM / CDRW Combo drive: 48X
 - **Monitor:** Dual 20-inch LCD Monitors
 - **Video:** ATI FireGL V3600, 256MB, dual DVI or
VGA graphics card (dual-monitor capable)
 - **Mouse:** USB Optical (2 button w/scroll)
 - **Keyboard:** Local USB country.
 - **Speakers:** External Speakers
 - **Network:** Redundant control network ports,
three Ethernet ports
 - **Options:** Local power cord
- **Software**
 - DeltaV software
 - Windows XP Professional OS with SP2 license
- **Environmental**
 - **Operating Temperature:** 10°C to 35°C (50°F to 95°F)
 - **Storage Temperature:** - 40°C to 65°C (- 40°F to
149°F)
 - **Relative Humidity:** 20% to 80% (non-condensing)
- **Chassis Size:**
 - **Height:** 17.6" (44.7cm)
 - **Width:** 6.8" (17.1cm)
 - **Depth:** 18.4" (46.8cm)
 - **Weight:** ~ 39.0lbs. (17.7kg)

Control Panel Elevation



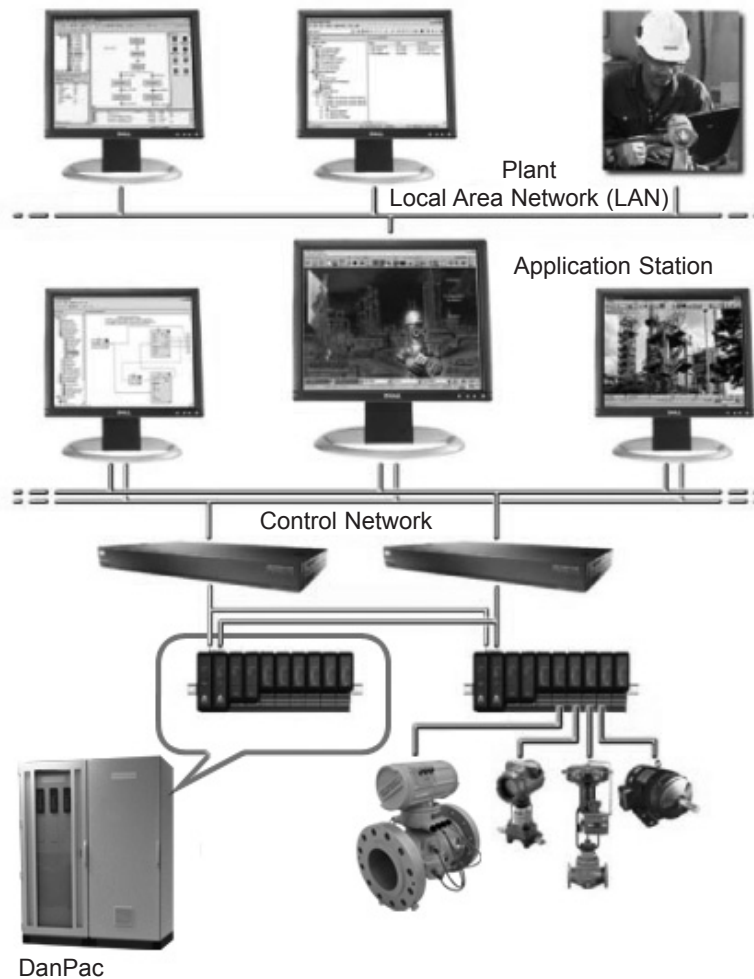
Typical 5 flow computer configuration

OPTIONAL FEATURES

Other product offerings may be available depending on the application. For world area locations and contact information, please refer to the back page of the datasheet.

PlantWeb™ Connectivity

DanPac's Logic controller, intelligent devices and AMS software work together as an integrated solution to form PlantWeb architecture, delivering precision control and turning the wealth of diagnostic data in intelligent field devices into actionable information.



DanPac network architecture

AMS® Device Manager

Provides the engineering interface to device calibration and configuration software for HART and Foundation fieldbus devices (licensed by AMS Suite: Intelligent Device Manager).

Report Generator

Accesses any historical data and brings it into your copy of Microsoft Excel for improved analysis and reporting.

Continuous Historian

Captures up to 250 analog, discrete and text parameters along with their status and stores them for future analysis. Optionally scalable up to 30,250 parameters.

OPC Data Server

Supporting sustained communication rates of up to 30,000 real-time values per second, the DeltaV OPC Data Server delivers fast, secure, reliable communications to client applications on the same machine or anywhere on your network. Scalable from 250 to 30,000 data values.

Uncertainty Analysis

The Uncertainty Analysis Module provides an automated solution for calculation of flow measurement uncertainty* of a liquid metering system. The basic features included are:

- Online logging of data and uncertainty analysis by the DanPac System
- Single or multiple liquid meter run system
- Meter prover with waterdraw base volume or master meter may be applied
- Inputs for meters, prover, pressures and temperatures
- API MPMS tables and correction factors
- Display and reports for measurement uncertainty of components and overall system

Analysis Features

- Uncertainty for instruments, meters and meter prover
- Ability to input laboratory testing of liquid characteristics
- Independent sources of errors
- Systematic random errors
- Application of sensitivity coefficient for each measurement
- Combined uncertainty for flow measurement system and delivery of liquid volume
- Square root sum of the squares method
- Calculations in accordance with API 11, API 12, API 13, ISO 5168 and Guide to Expression of Uncertainty in Measurement (GUM standard)
- Type A and B uncertainties

Benefits

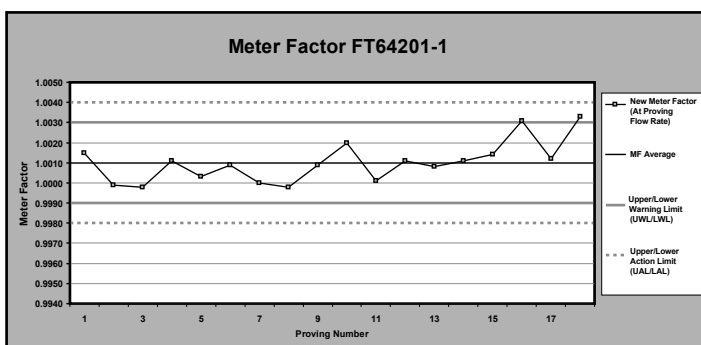
- Easy access to online calculations instead of audit manual calculations
- Monitors trends in measurement uncertainty of instruments and components
- Assists operations and management in identifying sources of errors
- Continued monitoring and evaluation of changes and corrective actions
- Optimization of volumetric or mass measurement of liquid commodities sold or purchased

Meter Error Calculations									
As of Date: 10/8/2008 11:32:00 AM									
Print Date: 11/24/2008 5:43:00 PM									
Meter Number: 21									
Gross Vol.	GST	GSV/GSTD	Mass Tons	Dry Vol. NSV	Dry Vol. SSDL	CTL	Meter FM	CPL	
2.0000000	1.95774000	1.96029024	0.272290531	1.959790000	1.959790000	0.9798704	0.541092299	1.001205195	
2.0000000	1.95769000	1.960287730	0.272278226	1.959616000	1.959616000	0.9798254	0.541092478	1.001205911	
2.0000000	1.95774000	1.960300292	0.272291221	1.959712000	1.959712000	0.9798704	0.541092299	1.001207295	
2.0000000	1.95772900	1.960308028	0.271870944	1.959270000	1.959270000	0.9798664	0.541541527	1.001202070	

Prover Error Calculations											
Prover Meter Number: 21											
Prover Run: 22											
Rho Base Dens. Vol.	Meter Factor	CTSP	CPSP	CTLP	CPLP	FP	CTLM	Prover FM	Prover FM	CCFP	CCFM
0.9797242274	1.00159	1.00007	1.00074	0.97997	1.00120	0.54109	0.97997	0.54109	1.00131	0.99170	0.99015
0.9797242274	1.00154	1.00008	1.00074	0.97993	1.00120	0.54108	0.97987	0.54108	1.00131	0.99166	0.99015
0.9797242274	1.00159	1.00007	1.00074	0.97997	1.00120	0.54109	0.97987	0.54109	1.00131	0.99171	0.99015
0.9791220482	1.00158	1.00007	1.00074	0.97970	1.00120	0.54117	0.97970	0.54117	1.00132	0.99154	0.97999

Combined Total Uncertainty				
As of: 10/8/2008 11:32:00 AM				
Print Date: 11/24/2008 5:55:00 PM				
Meter Run Uncert %	Meter Run Batch Vol. (NSV.)	Meter Run Uncert. Vol (Ubvols.)	Skid Ubv %	
0.08408100000	0.00	0.0000		
0.08104900000	0.00	0.0000		
0.05709200000	560470.67	319.9839		
0.06445100000	547137.30	352.6355		
0.08094100000	452881.15	366.5665		
0.08529800000	536889.02	457.7572		
		2097158.14	1496.9431	0.07137960
Number of Meters Used	Skid Ubv %	Total Calculated Uncertainty		
4	0.07137960	0.056		

Root Sum of Squares Combined Metering Errors									
As of Date: 10/8/2008 11:32:00 AM									
Print Date: 11/24/2008 6:44:00 PM									
Meter	Error NSV	Error Meter Proving Error	Error Calculation Tolerance	Error Turbine Meter Repeat.	Error Meter Proving Repeat.	Error Temp. Meas.	Error Press. Meas.	Error API Meas.	Error S&W Meas.
A	0.084861	0.030330	0.001	0.0500	0.0200	0.00637	0.00020	-0.01553	0.00100
B	0.081848	0.030330	0.001	0.0700	0.0200	0.00638	0.00020	-0.01760	0.00100
C	0.057892	0.030330	0.001	0.0400	0.0200	-0.00633	0.00015	-0.01725	0.00100
D	0.064451	0.030500	0.001	0.0500	0.0200	-0.00454	0.00020	-0.01725	0.00100
E	0.080941	0.030330	0.001	0.0700	0.0200	0.00597	0.00020	-0.01714	0.00100
F	0.085296	0.030500	0.001	0.0750	0.0200	-0.00454	0.00020	-0.01725	0.00100



Example reports

* The term "uncertainty," as used herein, reflects the industry's understanding of accepted deviation in measurement.

Reports

- **S600 Flow Computer Reports**

- Maintenance
- Base Time
- Prover Volume
- Alarm Archive
- Event Archive
- Constant Log
- Configuration Report
- Wire Report
- Display
- Security
- Alarm
- Modbus Maps

- **Agency Reports**

- **Liquid:**

API 2540 (Tables 5, 5A, 5B, 5D, 6, 6A, 6B, 6D, 23, 23A, 23B, 23D, 23E, 24, 24A, 24B, 24C, 24D, 24E, 53, 53A, 53B, 54, 54A, 54B, 54C, 54D, 59A, 59B, 60A, 60B), API 11.1, API 11.2.1, API 11.2.1M, API 11.2.2, API 11.2.2M, API 11.2.4, API 12.2.1, API 12.2.1M, API 12.2.2, API 12.2.2M, ASTM D1555-95, GPA TP15, GPA TP15M, GPA TP16, GPA TP25, GPA TP27, Steam & Water IAPSW 1967, NPD, CTSm, CPSm, Solartron / MicroMotion densitometer algorithms, Sarasota / PEEK densitometer algorithms

- **Gas:**

AGA 3, AGA 5, AGA 7, AGA 8, AGA 10, GPA 2172 & 2145, ISO 5167, ISO 6976, ISO12213 – 2 & 3, GOST 8.563.1 & 2 (97), GOST 8.586, GOST 30319, PR 50.2.019, NX 19, SGERG, VDI/VDE 2040, PTZ, Annubar, V-Cone

```

=====
CURRENT REPORT      12/12/2008 15:11:44
=====

STATION 1 FQIC STN01

CUMULATIVE          FLOW RATE
GVOL      3986.40    m3      195.93    m3/h
SVOL      3687.40    Sm3     181.15    Sm3/h
MASS     3311488.05  kg      162678.95 kg/h
IVOL      3986.40    m3      195.93    m3/h

=====
STREAM 1 FQIC 481      STATUS:ON-LINE

CUMULATIVE          FLOW RATE
GVOL      1993.20    m3      97.96     m3/h
SVOL      1843.69    Sm3     90.54     Sm3/h
MASS     1655734.98  kg      81300.29 kg/h
IVOL      1993.20    m3      97.96     m3/h

PIT-481      1410.506    kPa.g
TIT-481      114.000    Deg.C
DIT-473      898.000    kg/m3

=====
STREAM 2 FQIC 482      STATUS:ON-LINE

CUMULATIVE          FLOW RATE
GVOL      1993.20    m3      97.96     m3/h
SVOL      1843.71    Sm3     90.62     Sm3/h
MASS     1655753.07  kg      81378.66 kg/h
IVOL      1993.20    m3      97.96     m3/h

PIT-482      2265.000    kPa.g
TIT-482      114.000    Deg.C
    
```

Batch Summary Report

Skid ID : EGTL-Unit 83 As of Date Time : 1/15/2009 11:35:12AM
 Product Type : Crude Print Date Time : 10/20/09 1:23:23AM
 Time Used : 23:59:59 Avg. Loading Rate : 7.712:20 (m³/hr)

EGTL-Unit 83 Totals

	Gross Std. Volume (m³)	Net Std. Volume (m³)	Metric Tons
84.511.00	91,441.80	92,347.90	32,232.309 00

Meter ID	Density (Kg/m³)	Pressure (bar g)	Temperature (°C)
8100-FI-481	0.95	52.20	72.29
8100-FI-482	1.03	34.40	78.07
8100-FI-483	0.95	29.30	72.51

Meter ID	Std. Volume (m³)	Gross Std. Volume (m³)	Net Std. Volume (m³)
8100-FI-481	37,392.00	37,127.60	37,492.30
8100-FI-482	37,553.00	44,792.40	45,240.30
8100-FI-483	9,556.80	9,521.90	9,615.40

Meter ID	Metric Tons
8100-FI-481	12,574.110 00
8100-FI-482	16,433.480 00
8100-FI-483	3,224.769 00

* Indicates to the left of Asterisk is in Override

Checked By: _____ Checked By: _____
 Checked By: _____ Checked By: _____

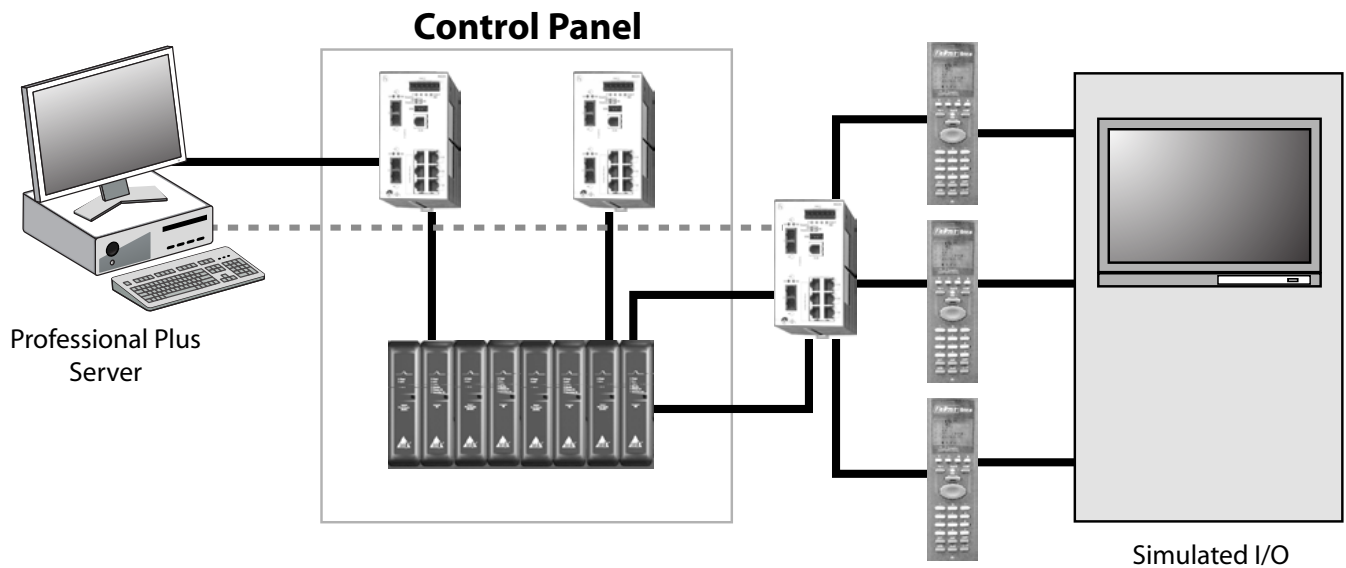


Example of base time and alarm reports.

FACTORY ACCEPTANCE TEST MODEL*

This procedure details the Factory Acceptance Test performed by Daniel Quality Control Test Engineers. All checks are performed utilizing the skid electrical drawings. The following tests are performed to ensure the skid instrumentation and the control system is functioning as per approved specifications:

- **Skid Instrumentation Visual Checks**
- **Control System Visual Checks**
- **Skid Dimensional Checks**
- **Custom Configuration and I/O**
- **HMI Function Checks**



Example of a FAT model

* FAT Model / Protocol available upon request

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