

CAMERON Scanner 2000 Series Flow Computers

Experience low-power measurement using a stand-alone CAMERON® Scanner® 2000 series flow computer or a network of Scanner devices in a large-scale SCADA solution. Scanner 2000 Series instruments are available in wired or wireless configurations, ready for installation.



Scanner 2000

- Wired communications
- Three conduit entries (capacity for five with optional terminal housing)
- MVT, turbine mount or remote mount
- Explosion-proof* and intrinsic safety approvals
- Expandable I/O
- FOUNDATION™ fieldbus communications available

Scanner 2100

- Wireless short-haul communications
- Five conduit entries (capacity for eight with optional MVT adapter)
- MVT or remote mount
- Explosion-proof* approval
- Easy battery access

Scanner 2200

- Wireless long-haul communications
- Large weatherproof* enclosure with integral shelf for radio
- Powered by lithium battery, DC, or solar power
- Available with integral charge controller/DC power supply and a rechargeable battery
- Generous I/O capacity

CAMERON Scanner 2000 series flow computers are among the most versatile flow measurement devices on the market. Each device can operate independently as a flow computer, RTU, or process controller, or act as a node in a comprehensive SCADA network.

The first-born member of the product family, the Scanner 2000 EFM, provides a dependable replacement for manual chart recorders and pressure/temperature indicators.

The Scanner 2100 builds on the Scanner 2000 functionality with short-haul SmartMesh® wireless communications for cost-effective networking of measurement devices, twice the battery capacity of the Scanner 2000, and added conduit entries.

The Scanner 2200 completes the offering with a roomy weatherproof package providing ample space for a radio or other long-haul communications devices, a charge controller/DC power supply, and a rechargeable battery for solar-powered installations.

All three Scanner 2000 Series devices share common computational capabilities, integral lithium battery power, and an easy-to-use, full-featured interface software for configuration and maintenance. Models vary in packaging, communications, I/O capacity, and hazardous area certifications.

* Explosion-proof, weatherproof, and/or intrinsically-safe as defined by CEC, NEC, ATEX, IEC, and CE codes.

Versatile Measurement

Scanner 2000 flow computers can measure standard volume, mass, and energy flows of saturated steam and many types of gases and liquids. All measurements are custody transfer caliber and are supported with comprehensive records that comply with requirements such as Sarbanes-Oxley, FERC 23, and Directive 17.

The Scanner 2000 series flow computer can operate autonomously on an internal lithium battery for up to a year or longer. When external power is applied, the lithium battery pack is on standby to ensure uninterrupted measurement without an expensive reserve power system.

Using an integrated sensor for differential pressure, absolute pressure and temperature measurements, this self-contained flow computer is a true chart recorder alternative. When connected to additional flow meters, a single

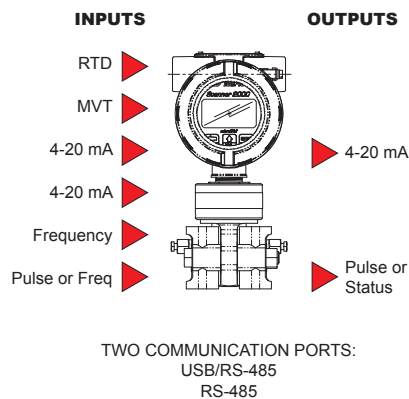
Scanner 2000 is powerful enough to measure the gas, oil, and water from a two- or three-phase separator. The Scanner 2000 is compliant with a comprehensive list of flow measurement standards to satisfy custody transfer applications.

Scanner flow computers can be factory-mounted and configured to Cameron orifice or cone meters for cost savings and efficient field commissioning. They can also be remote-mounted to automation devices and flow meters, including Cameron gas and liquid turbine and ultrasonic meters.

Data Logging

Scanner 2000 series EFMs can monitor multiple values simultaneously, including those used solely for process automation. In fact, when it comes to timely data, the Scanner 2000 series surpasses expectations for RTU/flow computer performance in delivering high-resolution data for process system analysis.

In addition to recording daily logs, Cameron allows users to log up to 16 measurements as frequently as every five seconds for monitoring flow-sensitive processes such as well startup or well testing. The duration of the interval log varies depending on device memory and configuration.



Control

Scanner 2000 series flow computers allow threshold values to be assigned to any measured or computed value for controlling a process with a status output. The output can be configured to trigger when one or all selected conditions exceed the threshold, and can be latched (requiring user acknowledgment to reset) or unlatched for automatic reset.

When equipped with a 4 to 20 mA output option and a PID control option*, Scanner 2000 Series computers can effectively control process variables such as static pressure, differential pressure, temperature, and flow rate. The output is configured to regulate a control valve or an adjustable speed drive, and control parameters are tuned with the software provided. A Scanner EFM can control a single parameter or a single parameter in combination with a secondary pressure control.

**Not available with Scanner 2100 EFM, FOUNDATION™ fieldbus communications or intrinsic safety.*

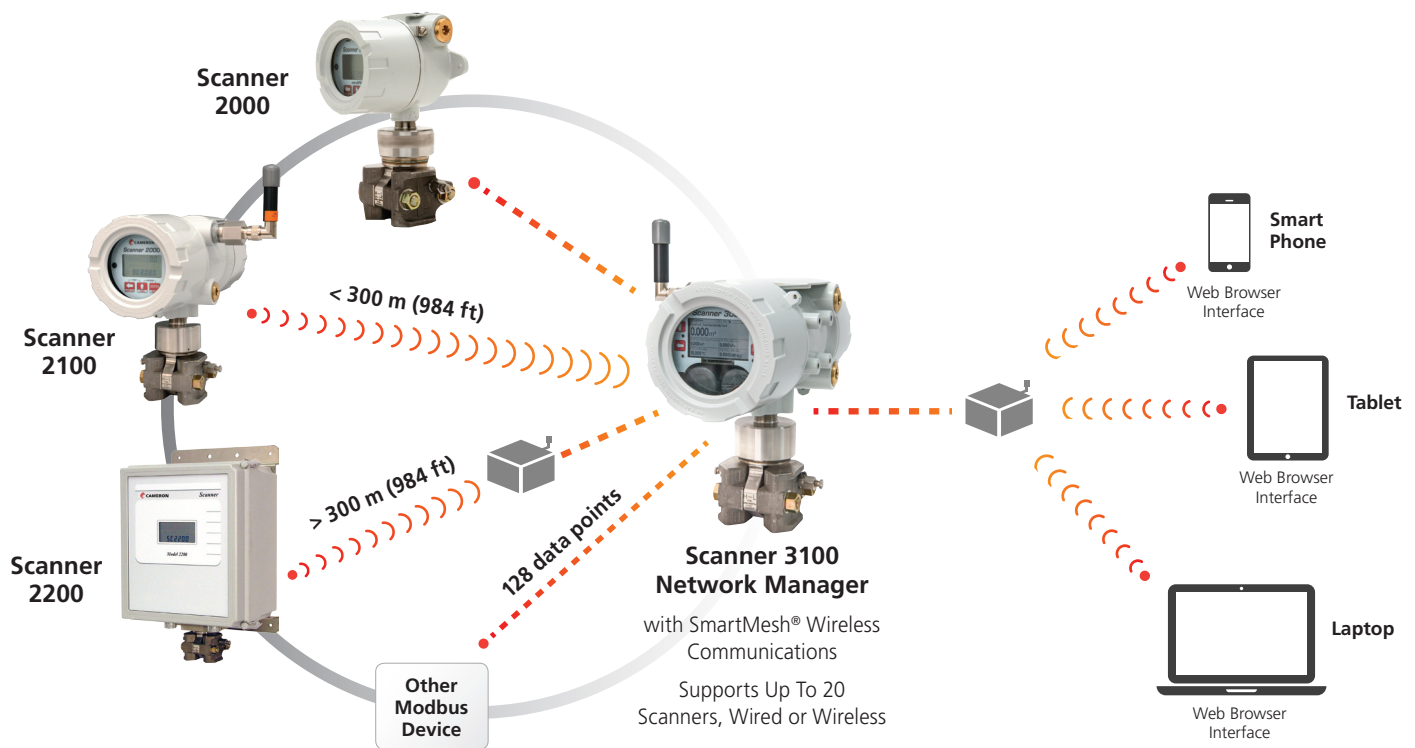


FOUNDATION™ Fieldbus Communications



The Scanner 2000 model for FOUNDATION fieldbus is certified by the Fieldbus Foundation for interoperability. Unlike the standard Scanner 2000, the fieldbus network supplies power for normal operations.

A fieldbus host may read differential pressure, pressure, temperature and flow rate from analog input blocks while additional measurement variables may be read from transducer blocks. The remaining RS-485 serial port may be used to collect Modbus® data or history logs or to configure or maintain flow run information.



Distributed Automation Solution

When automation requirements exceed the capacity of a single flow computer, Cameron's networking innovation provides a cost-saving solution. Through the deployment of multiple Scanner computers and a web-accessible Scanner 3100 network manager, Cameron's distributed processing solution equips users to access data for up to 22 flow streams through a single device and provides enhanced data protection.

Unlike centralized automation systems where lost or delayed data transmissions threaten the integrity of flow computations, Cameron's solution is, by design, immune to these risks. Each computer measures and logs the flow data at the point of measurement before sending a copy to the network manager, so even if a transmission fails, the data remains secure and API compliant. Should communications be interrupted, the Scanner computers and the network manager automatically synchronize to restore missing data records.

Other benefits include the following:

- Reduced cost – Installation costs are reduced by reliance on two-wire RS-485 communications, rather than six or more electrical conductors.
- System overload protection – Computing capacity increases with each computer added to the network, so the system is not easily overloaded.




- Reduced dependency on power – Each Scanner 2000 can operate for months on a single battery pack so if power is lost, measurements continue uninterrupted.
- Local data access – Current flow results are displayed at the point of measurement.

Wireless Flow Computing

The potential for cost savings of up to 50% on flow computer installation has sparked growing interest in wireless communications for the oil and gas industry. However, opportunities for integrating wireless into the flow computer business were very limited by conventional automation systems that depend on the failsafe delivery of input data. Cameron's innovative use of low-power flow computers for capturing primary measurements and computing results – and storing them at the point of measurement – has revolutionized the use of wireless as a viable flow computing option. With its redundant storage technique, Cameron customers can optimize their deployments with a combination of Scanner 2000 series models and wireless or wired communications without compromising data integrity.

For more information, see the CAMERON Flow Computer Solutions brochure.

Scanner 2000 Series Model Specifications

| | Scanner 2000 | Scanner 2100 | Scanner 2200 |
|------------------------------|---|--|--|
| |  |  |  |
| Approvals | | | |
| CSA (US and Canada) | Explosion-proof* Class I, Div. 1, Groups B, C, D, T6 FOUNDATION Fieldbus, optional | Explosion-proof* Class I, Div. 1, Groups C, D, T6 | — |
| | Non-arcing Class I, Div. 2, Groups A, B, C, D, T6 | — | Class I, Div. 2, Groups A, B, C, D, T4 Rated for Internal Pollution Degree 2 |
| | Type 4 weatherproof* rating | Type 4 weatherproof* rating | Type 4 or 4X weatherproof* rating (4X requires MVT with stainless steel or inconel bolts) |
| | ANSI 12.27.01 single seal (MVT ≤ 3000 psi) | ANSI 12.27.01 single seal (MVT ≤ 3000 psi) | ANSI 12.27.01 single seal (MVT ≤ 3000 psi) at process temperatures from -40° F to 250° F (-40° C to 121° C) |
| ATEX and IECEx | Explosion-proof Equipment Group II, Category 2 for Gas, Dust Ex d IIC Gb T6 Ex tb IIIC Db T85C IP66 weatherproof rating FOUNDATION Fieldbus, requires communications isolation accessory | Explosion-proof* (pending) | — |
| | CE | — | — |
| | EMC Directive 2004/108/EC | — | — |
| ATEX | Intrinsically Safe Equipment Group II, Category 2 for Gas Ex ia IIB T4 Gb IP66 weatherproof* rating | — | — |
| | CE | — | — |
| | EMC Directive 2004/108/EC | — | — |
| Other | ASME (MVT ≤ 3000 psi); CRN OF10472.5C | ASME (MVT ≤ 3000 psi); CRN OF10472.5C | ASME (MVT ≤ 3000 psi); CRN OF10472.5C |
| | Measurement Canada, (MVT ≤ 1500 psi) AG-0557C | — | — |
| | GOST-R/GOST-K | — | — |
| Operating Temperature | -40° F to 158° F (-40° C to 70° C) | -40° F to 158° F (-40° C to 70° C) | Standard: 5° F to 122° F (-15° C to 50° C) Extended range with optional battery: -40° F to 140° F (-40° C to 60° C) |

| | Scanner 2000 | Scanner 2100 | Scanner 2200 |
|--------------------------------|---|---|---|
| Physical | | | |
| Enclosure | Cast aluminum (less than 0.05% copper), painted with epoxy and polyurethane | Cast aluminum (less than 0.05% copper), painted with epoxy and polyurethane | Fiberglass, weatherproof* rectangular |
| | Single-ended with window | Double-ended with window | |
| | Three conduit entries, 3/4" NPT, standard; capacity for five conduit entries with optional terminal housing | Five conduit entries, 3/4" NPT, standard; capacity for eight conduit entries with optional four-port MVT adapter | Two conduit entries, 1/2" NPT hubs plus one sealed hole |
| | Dimensions: 5.71" wide, 5" deep, 9.6" tall with MVT, 7.92" tall with turbine mount adapter | Dimensions: 5.43" wide, 11.28" deep, 10.76" tall | Dimensions: 12" wide, 8" deep, 14" tall |
| Display/Keypad | Two-line scrolling LCD displays up to 12 user-defined parameters and up to 99 daily logs | Two-line scrolling LCD displays up to 12 user-defined parameters and up to 99 daily logs | Two-line scrolling LCD displays up to 12 user-defined parameters |
| | Three-key membrane switch supports limited configuration for device maintenance | Three-key membrane switch supports limited configuration for device maintenance | — |
| Weight | 11.2 lb (5.08 kg), approximate (with MVT) | 17.3 lb (7.85 kg) with MVT and antenna | 50 lb (22.7 kg), approximate (with a rechargeable battery and MVT) |
| Mounting Options | Direct mount to turbine meter, cone meter, orifice meter, or remote mount to 2" pole | Direct mount to cone meter or orifice meter, or remote mount to 2" pole | Wall mount or 2" pole mount |
| Power | Lithium double-D battery pack (air transport regulations apply) | Lithium double-D battery pack (holds two packs) (air transport regulations apply) | Lithium double-D battery pack (air transport regulations apply) |
| | External power supply (6 to 30 VDC) with internal lithium battery backup | External power supply (6 to 30 VDC) with internal lithium battery backup | External power supply (16 to 28 VDC) or solar power Optional 12 V, 33-amp/hour rechargeable battery/charge controller with 24 V output for powering external instruments |
| | Fieldbus power supply with internal lithium battery backup | — | — |
| Communications/ Archive | Wired | Short-haul wireless** or wired | Long-haul wireless or wired |
| | Two onboard RS-485 ports (reduced to one port for intrinsically safe device, FOUNDATION Fieldbus device or when an external USB or RS-485 adapter is installed) | Two onboard RS-485 ports (reduced to one port for a wireless device or when an external USB or RS-485 adapter is installed) | One onboard RS-485 port; second port shared by three connections supports USB, RS-232 or RS-485 (only one can transmit/receive at a time) |
| | Modbus protocol | Modbus protocol | Modbus protocol |
| | 300 to 38.4K baud | 300 to 38.4K baud | 9600 to 38.4K baud |
| External Connections | USB or RS-485, optional | USB or RS-485, optional | USB, standard |
| Wireless Communications | — | IEEE 802.15.4 2.4GHz SmartMesh wireless radio with time-slotted channel hopping (supports network communications to Scanner 3100 network manager)** | Any third-party communication device (spread spectrum, cellular, satellite, etc.). Power control provided by Scanner based on state of charge or time of day. |
| Accessories | — | Antennas and cables | Antennas and cables, serial-to-Ethernet converter |
| FOUNDATION Fieldbus | Optional with explosion-proof* rated device | — | — |

| | Scanner 2000 | Scanner 2100 | Scanner 2200 |
|---------------------------|---|---|--|
| Inputs and Outputs | | | |
| Turbine Input | One | One | Two |
| Pulse Input | One with I/O expansion board (can be a second turbine input) | One with I/O expansion board (can be a second turbine input) | Two |
| Process Temp. Input | One | one | One |
| Analog Input | Two with I/O expansion board | Two with I/O expansion board | Two |
| Digital Output | One | One | Two |
| Analog Output | One with I/O expansion board | One with I/O expansion board | One |
| Data Logging | Up to 16 user-selected parameters; adjustable logging frequency from 5 seconds to 24 hours | Up to 16 user-selected parameters; adjustable logging frequency from 5 seconds to 24 hours | Up to 16 user-selected parameters; adjustable logging frequency from 5 seconds to 24 hours |
| | Daily records: 768 (> 2 years) | Daily records: 768 (> 2 years) | Daily records: 768 (> 2 years) |
| | Interval (hourly) records: 2304 (> 3 months) standard; 6392 (> 8 months) with I/O expansion board | Interval (hourly) records: 2304 (> 3 months) standard; 6392 (> 8 months) with I/O expansion board | Interval (hourly) records: 6392 (> 8 months) |
| Hardware Options | I/O expansion board (not available with FOUNDATION fieldbus communications) | I/O expansion board (not available with SmartMesh wireless communications) | — |
| | PID control (requires I/O expansion board) | PID control (requires I/O expansion board) | PID control |
| | External USB adapter | External USB adapter | — |
| | External RS-485 adapter | External RS-485 adapter | — |
| | Momentary control switch | Momentary control switch | — |
| | — | Toggle power switch | — |
| | — | Four-port MVT adapter (adds four additional conduit entries for factory-installed accessories) | — |
| | Terminal housing (adds two conduit entries); approved for Class I, Div. 1, Groups C and D installations only) | — | — |
| RTD temperature sensors | RTD temperature sensors | RTD temperature sensors | |

* Explosion-proof, weatherproof, and/or intrinsically-safe as defined by CEC, NEC, ATEX, IEC, and CE codes.

** A Scanner 3100 network can support up to 20 wired or wireless Scanner 2000 Series devices. For details, see the Scanner 3100 technical data sheet and the Scanner SCADA Solutions brochure.

Calculations

Scanner 2000 Series flow computers support the following industry standard calculations:

- Flow rate (natural gas, steam, or liquid)
 - AGA-3 (1992 and 2012)
 - AGA-7
 - ISO 5167
 - ASME MFC-14M
 - Cone
 - Averaging pilot tube
- Fluid properties
 - AGA-8-94 (detail and gross)
 - AGA-3, App. F
 - GPA 2145
 - IF-97 (steam)
 - Generic liquid (water or emulsions)
 - API 11.1
- Wet correction (steam)
 - James (orifice meters)
 - Chisolm-Steven (orifice and cone meters)

Input/Output Specifications

(see page 6 for model-specific I/O counts)

| | |
|---------------------------|---|
| Turbine input | Configurable sensitivity adjustment (20 to 200 mV, peak-to-peak) |
| | Frequency range: 0 to 3500 Hz |
| | Input amplitude: 20 to 3000 mV, peak to peak |
| | With the Scanner 2200, Turbine Input 2 can be used simultaneously as an input status. |
| Process Temperature Input | 100 ohm platinum RTD with two, three or four-wire interface |
| | Sensing range: -40° F to 800° F (-40° C to 427° C) |
| | Accuracy: 0.36° F (0.2° C) over sensing range at calibrated temperature |
| | Temperature effect: 0.54° F over operating range of -40° F to 158° F (0.3° C over operating range of -40° C to 70° C) |
| Pulse Input | Accepts a signal from a turbine meter or PD meter |
| | Optically isolated |
| | Input: 3 to 30 VDC or contact closure |
| Analog Input | Three-wire sensor interface (0 to 5 V, 1 to 5 V, 4 to 20 mA) |
| | Sensor power same as external power supply for main board (6 to 30 VDC) |
| | Accuracy: 0.1% of full scale |
| | Temperature effect: 0.25% of full scale over operating temperature range of -40° F to 158° F (-40° C to 70° C) |
| | Resolution: 20 bits |
| | User-adjustable sample time and damping |
| Digital Output | Configurable as pulse output or alarm output |
| | Solid-state relay |
| | Output rating: 60 mA maximum at 30 VDC |
| | Pulse output: Configurable pulse duration Maximum frequency: 50 Hz Configurable pulse representation (1 pulse = 1 MCF) Based on any accumulator (flow run or turbine inputs) |
| | Alarm output: Low/high Out-of-range Status/diagnostic Latched/unlatched Normally open/normally closed |
| | |
| Analog Output | 4 to 20 mA |
| | Accuracy: 0.1% of full scale at 77° F (25° C) Temperature drift: 27.8 PPM/° F (50 PPM/° C) |
| | Represents any measured variable (e.g., differential pressure) or calculated parameter (e.g., flow rate) |
| | Regulates control valve in PID control applications |
| | Optically isolated |
| | Resolution: 16 bits |
| MVT | Linearized digital data for static pressure (absolute) and differential pressure |
| | Available with bottom ports (gas) or side ports (liquid or steam) |
| | Complies with pre-qualified materials of NACE MR0175/ISO 15156* |
| | Process temperature: -40° F to 250° F (-40° C to 121° C) |
| | User-adjustable sample time and damping |

* This certification does not imply or warrant the application of the MVT in compliance with NACE MR0175/ISO 15156 service conditions in which the MVT is installed.

MVT Pressure Ranges

| Static Pressure/SWP (PSIA) | Differential Pressure (in. H ₂ O) | Maximum Overrange Pressure (PSIA) |
|----------------------------|--|-----------------------------------|
| 100 | 30 | 150 |
| 300 | 200 | 450 |
| 500 | 30 | 750 |
| 1500 | 200 | 2250 |
| 3000 | 400 | 4500 |
| 5300 | 400 | 7420 |
| | 840 | 7420 |

Other custom ranges available on request.

MVT Accuracy

- Differential pressure (DP): ± 0.05% of span
 - Effect on DP for a 1000-psi change in pressure
 - Zero shift: ± 0.05% of URL
 - Span shift: ± 0.01% of reading
- Static pressure: ± 0.05% of span
- Temperature performance: 0.25% of full scale over full operating temperature range

Effect on DP for a 100-psi pressure change

| Range (in H ₂ O) | Zero Shift (% URL) | Span Shift (% reading) |
|-----------------------------|--------------------|------------------------|
| 30 | .05 | .01 |
| 200* | .01 | .01 |
| 400 | .04 | .01 |
| 800 | .04 | .01 |

*Exception: 200 x 300 psi has a zero shift of .007% and a span shift of .01%

- Static pressure: ± 0.05% of range
- Temperature performance: 0.25% of full scale over full operating temperature range
- Stability: long-term drift less than ± 0.05% of URL per year over a five-year period
- Resolution: 24 bits

MVT materials of construction

| | |
|----------------------|---|
| Body bolts and nuts | B7/2H alloy steel, standard (see table below for alternate materials) |
| Process Cover | 316 SS* |
| Process Cover Gasket | Glass-filled PTFE |
| Diaphragm | 316L SS* |
| Vent/drain | SS bleed (316 SS plug is standard for NACE and coastal applications) |

* Other materials are available by special order

Body bolts & nuts (non-process wetted)

| | B7/2H alloy steel | B7M/2HM alloy steel | 316SS | 17-4 PH SS | Inconel 718 |
|----------------------------------|-------------------|---------------------|-------|------------|-------------|
| Suitable for NACE Application | NO | YES | NO | NO | YES |
| Suitable for Coastal Application | POSSIBLE* | POSSIBLE* | YES | NO** | YES |
| Max. Pressure Range (psi) | 5300 | 1500 | 1500 | 3000 | 5300 |
| Coating | Plated | Black oxide | - | - | - |

* B7 and B7M alloy steel is susceptible to corrosion.

** Chloride stress cracking risk.

Data Reporting Tool

Cameron's Scanner Data Manager software opens the Scanner data files created during a Scanner download, allowing users to view, print, and export flow/event/alarm logs and configuration data for sharing with others in a Windows-compatible format or for satisfying audit requirements. The software also converts data to Flow-Cal® and PGAS® formats.

Users can view flow data in tabular or trend displays and create a customized template for generating professional reports that are personalized with a company name and logo.

Configuration Interface

ModWorX™ Pro software is Cameron's custom interface for configuring and maintaining Scanner 2000 Series flow computers. Features include:

- 12-point calibration
- real-time polling
- downloads of flow logs, configuration data, and event/alarm records
- configuration file upload tool for configuring multiple units
- PID tuning controls (for units that are factory-configured with the PID control option)

Related Publications

For more information on Scanner 2000 Series EFM applications, see the following publications:

- CAMERON Flow Computer Solutions brochure
- Scanner 2000 microEFM Well Testing Solution brochure
- Scanner Data Manager technical data sheet
- PID Control feature profile
- Communications and Power Accessory Packages for CAMERON Scanner Series Flow Computers technical data sheet
- Series 20 RTDs technical data sheet

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