

Pressure decay or flow test instrument



Highlights

- » Pressure Decay or Mass Flow test methods
- » Wide-angle, high-resolution touchscreen user interface
- » Program calibration with CTS Performance Factor for grading test setup quality
- » Serial and Network bi-directional communication
- » Integral EtherNet/IP™ and PROFINET PLC protocols
- » USB or RS232 barcode scanner compatible
- » Built-in configurable digital I/O with 6 Inputs and 6 Outputs
- » Optional plug-and-play accessory upgrades of either Enhanced Fill or External Exhaust are available

Description

The Sentinel® BC5 is a basic single-channel pressure or flow test instrument designed for core functionality for use in manual or integrated in-process work cells and automation. Available in three bench/horizontal mount models:

- BC5 Absolute Pressure Decay
- BC5 Differential Pressure Decay
- BC5 Mass Flow (only)

Sentinel BC5 specifications

Instrument housing	BC5 bench/horizontal mount configuration
	10.5" w x 9" h x 11.25" d (267 x 229 x 286 mm)
Electrical	100-240 VAC, 50/60 Hz
Air quality	ISO 8573-1:2010 [2:2:2] Compressed air or nitrogen only
Pilot	60 psig (4.1 bar) minimum 120 psig (8.3 bar) maximum
Operating temperature	41–104° F (5–40° C)
Operating humidity	90% non-condensing
Digital I/O	6 inputs / 6 outputs (user-configurable, non-expandable), 24VDC – 1A max.
Instrument weight	Configuration dependent, up to 17 lbs

Sentinel BC5 Absolute Pressure Decay Features

Absolute pressure decay is typically executed by pressurizing the test part to a regulated value, then isolating the part from the compressed air supply and measuring any pressure loss over time utilizing an absolute pressure transducer. This test method is highly dependent upon the total volume of air being measured in the decision phase. As the absolute transducer measures the part pressure relative to its sealed vacuum reference, any barometric pressure transients are negated, which enhances accuracy and repeatability of decay measurement. This stands in contrast to industry common gauge transducer systems, where part pressure measurements are referenced to atmospheric pressure which is prone to small transients throughout the testing process when doors open close, HVAC systems cycle, etc. leading to less stable and less precise results.

ABSOLUTE PRESSURE DECAY TEST METHODS

- Pressure Decay – Leak Standard
- Pressure Decay – ΔP
- Pressure Decay – $\Delta P/\Delta T$
- Occlusion
- Pressure Verify

PRESSURE MEASUREMENT

Test pressure and pressure decay

Displayed resolution: Range is selectable X to X.XXXXXX for each measurement unit

Absolute pressure transducer ranges available

Range	Measurement	Resolution
0–20 psia	-14.7 to 5 psig	0.000004 psig
0–45 psia	-14.7 to 30 psig	0.000008 psig
0–115 psia	-14.7 to 100 psig	0.000021 psig
0–215 psia	-14.7 to 200 psig	0.000040 psig

Leak rate

Displayed resolution: Selectable from X to X.XXXXXX for each measurement unit

LEAK STANDARD OPTIONS

- External leak standard quick-disconnect port on front panel
- External leak standard quick-disconnect port on front panel valve-coupled to test circuit on-demand
- No leak standard port

PRESSURE REGULATION AVAILABLE

Instrument maximum: 1

Mechanical regulator ranges

-0.5 to -14.5 psig (-1.0 to -29 inHg)
 -0.5 to -12.7 psig (-1.0 to -26 inHg) w/integral Venturi vacuum generator
 0.2 to 2.0 psig
 0.5 to 10 psig
 1.0 to 30 psig
 2.0 to 100 psig
 3.0 to 200 psig

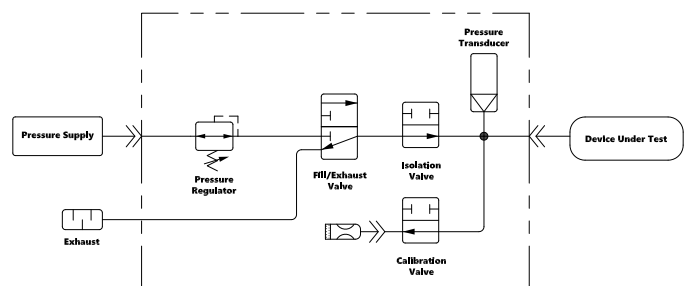
Electronic regulator ranges

-0.5 to -14.5 psig (-1.0 to -29 inHg)
 -0.5 to -12.7 psig (-1.0 to -26 inHg) w/integral Venturi vacuum generator
 0.2 to 2.0 psig
 0.5 to 10 psig
 1.0 to 30 psig
 2.0 to 100 psig
 3.0 to 200 psig

QUIK TEST FUNCTION

- Monitors the in-test pressure change value real-time and concludes the testing process early when it is obvious that an accept or reject result is imminent
- Reduces cycle time for the majority of production parts tested

Absolute Pressure Decay Test Circuit



Sentinel BC5 Differential Pressure Decay Features

Differential pressure decay is executed by first pressurizing the test part plus a reference volume to a regulated value, second isolating both from the compressed air supply, third isolating the test part from the reference volume, and finally measuring any pressure loss over time between the part and reference volume utilizing a differential pressure decay transducer. This test method is also highly dependent upon the total volume of air being measured in the decision phase. As the differential transducer measures only pressure changes between the part and sealed reference volume, a lower pressure range transducer can be implemented which enhances resolution, accuracy and repeatability of the decay measurement. CTS differential transducers use piezoresistive diaphragms which have near zero drift throughout their life, in contrast to industry common capacitive diaphragm transducers, which are prone to drift and often require complex periodic factory recalibration.

DIFFERENTIAL PRESSURE DECAY TEST METHODS

- Differential Pressure Decay – Leak Standard
- Differential Pressure Decay – Leak Rate
- Differential Pressure Decay – ΔP
- Differential Pressure Decay – $\Delta P/\Delta T$
- Occlusion

MEASUREMENT RESOLUTION

▪ Differential decay measurement

Differential resolution (instrument pressure range dependent):

- ≤ 100 psig: 0.0000005 psig (0.0035 Pa)
- 200 psig: 0.000001 psig (0.007 Pa)

Displayed resolution: Range is selectable X to X.XXXXXX for each measurement unit

▪ Test pressure

Absolute pressure transducer ranges available

Range	Measurement	Resolution
0–20 psia	-14.7 to 5 psig	0.000004 psig
0–45 psia	-14.7 to 30 psig	0.000008 psig
0–115 psia	-14.7 to 100 psig	0.000021 psig
0–215 psia	-14.7 to 200 psig	0.000040 psig

▪ Leak rate

Displayed resolution: selectable from X to X.XXXXXX for each measurement unit

PRESSURE REGULATION AVAILABLE

▪ Instrument maximum: 1

Mechanical regulator options

-0.5 to -14.5 psig
(-1.0 to -29 inHg)
-0.5 to -12.7 psig (-1.0 to -26 inHg) w/integral Venturi vacuum generator
0.2 to 2.0 psig
0.5 to 10 psig
1.0 to 30 psig
2.0 to 100 psig
3.0 to 200 psig

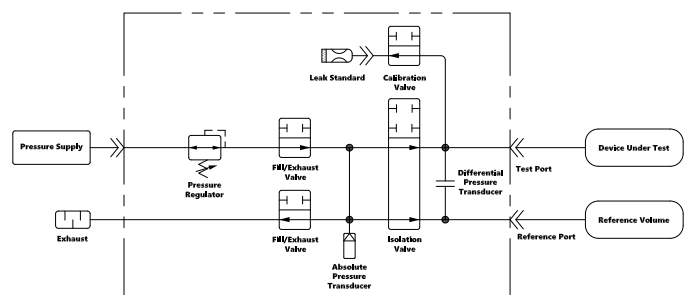
Electronic regulator options

-0.5 to -14.5 psig
(-1.0 to -29 inHg)
-0.5 to -12.7 psig (-1.0 to -26 inHg) w/integral Venturi vacuum generator
0.2 to 2.0 psig
0.5 to 10 psig
1.0 to 30 psig
2.0 to 100 psig
3.0 to 200 psig

LEAK STANDARD OPTIONS

- External leak standard quick-disconnect port on front panel
- External leak standard quick-disconnect port on front panel valve-coupled to test circuit on-demand
- No leak standard port

Differential Pressure Decay Test Circuit



Sentinel BC5 Mass Flow Features

Mass flow testing is typically executed by pressurizing the test part to a regulated value and then measuring how much air is needed to maintain that pressure using a precision thermal mass flow transducer between the air supply and test part. As measurement value corresponds directly to the actual airflow leaving the part, this test method operates independent of part volume and is often the preferred method when testing a multitude of unique part volumes where reject criteria are already based in units of flow (sccm or similar). It is also the optimum method of detecting defects in pathway geometry of parts whose pathways can be vented to ATM.

MASS FLOW TEST METHODS

- Mass Flow
- Mass Flow – Leak Standard
- Occlusion

FLOW AND PRESSURE MEASUREMENT

▪ Flow

Flow transducer ranges available

0.1–10 sccm

0.2–20 sccm

0.5–50 sccm

2–250 sccm

5–500 sccm

10–1,000 sccm

30–3,000 sccm

100–10,000 sccm

200–20,000 sccm

Flow measurement resolution: 0.01 sccm (all ranges)

▪ Flow/Leak rate

Displayed resolution: Selectable from X to X.XXXXXX for each measurement unit

▪ Test pressure

Displayed resolution: Selectable from X to X.XXXXXX for each measurement unit

Absolute pressure transducer ranges available

Range	Measurement	Resolution
0–20 psia	-14.7 to 5 psig	0.000004 psig
0–45 psia	-14.7 to 30 psig	0.000008 psig
0–115 psia	-14.7 to 100 psig	0.000021 psig
0–215 psia	-14.7 to 200 psig	0.000040 psig

ENHANCED MASS FLOW MEASUREMENT SYSTEM

- MPMA signal-conditioning improves test result repeatability by minimizing noise-related error induced by supply pressure fluctuations, part temperature transients, vibrations, etc.
- Achieved by averaging multiple measurement samples within a given timespan over several iterations/passes
- Conditioning is ongoing throughout the Test time, eliminating delays in delivering the final test result with reduced measurement noise

PRESSURE REGULATION AVAILABLE

▪ Instrument maximum: 1

Mechanical regulator options

-0.5 to -14.5 psig

(-1.0 to -29 inHg)

-0.5 to -12.7 psig (-1.0 to

-26 inHg) w/integral Venturi vacuum generator

0.2 to 2.0 psig

0.5 to 10 psig

1.0 to 30 psig

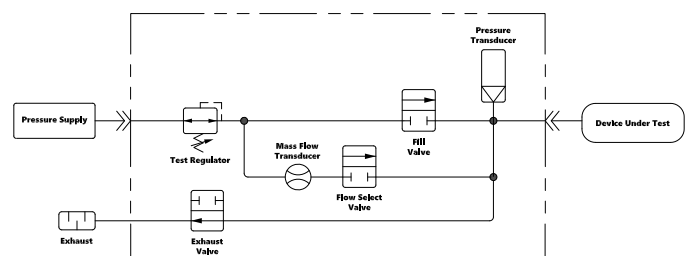
2.0 to 100 psig

3.0 to 200 psig

LEAK STANDARD OPTIONS

- External leak standard quick-disconnect port on front panel
- No leak standard port

Mass Flow (only) Test Circuit



Sentinel BC5 Features

VACUUM SOURCE GENERATION AVAILABLE

- Low-decibel 2-stage integral Venturi vacuum generator
- External electro-mechanical vacuum pump available for larger volume or higher vacuum requirements

100 TEST PROGRAMS

- Available programs are menu-sortable and selectable by ID #, Program Name, or Test Type. Within each program exist:
 - Test type selection and user-issued name
 - Timer durations and limits
 - Pressure targets and limits
 - Test result acceptance criteria
 - Pressure source selection, fill and exhaust methods, system fault management/reporting, program naming and copy/paste, barcode scanning requirements, units of measurement
 - Establishment of count and delay intervals of automatic cyclical testing (Autorun) for quantifying result repeatability
 - Digital and virtual I/O control

AUTOMATIC PROGRAM CALIBRATION

- Executes calibration of the test program using non-leaking test part(s) and a certified leak standard
- Allows batch-calibration (average of multiple-part values) if desired
- Permits authorized user-edits of calibration data if necessary

SELF-TEST AND SETUP VERIFICATION FUNCTIONS

- Diagnostic check of instrument for internal leaks
- Periodic program calibration verification using leak standards

ENVIRONMENTAL DRIFT CORRECTION

- When enabled, monitors and maintains the separation between expected accept results and reject limits by making continuous incremental adjustments (within user-defined limits) when changes in result trend occur due to shifts in part temperature and environmental conditions

TARGET PRESSURE CORRECTION

- Compares the programmed target test pressure vs actual test pressure and applies a correction to the test result relative to their difference as though the actual pressure were maintained at target value
- Maintains test accuracy and improves repeatability despite supply pressure fluctuations

TEST PORTS

- Single channel, 1 test port (non-expandable)
- 1/4" female quick-connect test port connection
- Imperial (NPT) or Metric (BSPT) threaded ports

ACCESSORY NETWORK MODULES AVAILABLE

- **Instrument maximum:** 1
- **Enhanced Fill Module**
 - Accelerated charging of often larger volume test parts to target pressures faster than via the instrument alone
 - All required control valve drivers and valves are included (does not require use of any instrument hardware I/O)

OR

- **External Exhaust Module**
 - Permits venting the test part externally when liquids, moisture or debris within the test part might contaminate the instrument's pneumatic circuit if vented internally
 - All required control valve drivers and valves are included (does not require use of any instrument hardware I/O)

UNITS OF MEASURE

- **Pressure:** psig, psiv, iWC, cmWC, mmWC, inHg, cmHg, mmHg, Pa, kPa, MPa, ksc, atm, bar, mbar, Torr
- **Flow:** sccm, sccs, scch, slpm, slps, slph, scfm, scfs, scfh
- **Time:** msec, sec, min, hour
- Each unit selectable either per program or globally (all programs)

RESULT MANAGEMENT AND ONBOARD STORAGE

- 50,000 test results stored in on-board memory, expandable through USB flash storage
- Result export to PC or PLC continuously or periodically via serial and/or network connections. Export to compliant PLCs via either EtherNet I/P or PROFINET protocols
- Test result log allows viewing of the last 500 cycles via display
- Resettable production counters including Accept, Reject and Malfunction cycles
- Statistical data tracking for process trending of:
 - Statistic Sample Size
 - Accept vs. Reject Percentage
 - Accept and Reject Averages
 - Accept Standard Average (mean)

Sentinel BC5 Features – Continued

CTSnet® REMOTE INSTRUMENT MANAGEMENT SOFTWARE

- Connectivity of instrument to user PC interface via network
- Remotely configure test programs and instrument settings
- View data and export reports
- Allows selection of and connection to any CTSnet compatible instrument on user's network, up to 10 simultaneously

SERIAL (RS232) COMMUNICATION PORT

- 2-way communication
 - Streaming of pressure and flow vs. time (20 points/second)
 - Continuous test result transmission based on selected fields
 - Remote test program selection
- Serial barcode scanner compatible for unique part identification

NETWORK (ETHERNET) COMMUNICATION PORT

- 2-way Telnet communication:
 - Streaming of pressure and flow vs. time (20 points/second)
 - Continuous test result transmission based on selected fields
 - Remote test program selection
 - Email two addressees with alerts and reports on demand
- EtherNet/IP™ PLC protocol with an additional 16 inputs/16 outputs (user configurable), fixed control (Start/Stop/Reset/Vent Halt/etc.), status (Ready/Accept/Reject/ Malfunction/ Test Active/etc.), program selection, live measurement data (during test), result status, and user latches
- PROFINET PLC protocol with an additional 16 inputs/16 outputs (user configurable), fixed control (Start/Stop/Reset/Vent Halt/etc.), status (Ready/Accept/Reject/Malfunction/Test Active/etc.), program selection, live measurement data (during test), result status, and user latches

DUAL EXTERNAL USB PORTS

- Report and test result data storage and automated result synchronization
- USB barcode scanner compatible for unique part identification
- Backup/restore of instrument functions
- Firmware updates

7" TFT IPS TOUCHSCREEN INTERFACE

- Icon-based menu navigation
- Basic, Advanced and Admin viewing modes
- Graphing of pressure and flow vs. time curves with position and zoom adjustment
- Displays activity status of digital and virtual I/O

UNIQUE USER SECURITY PROFILES

- Allows for the creation of up to 10 user IDs, each with unique password and admin selectable permissions for viewing-only, editing and functional use of:
 - Program (test setup) settings
 - System (communication) settings
 - Hardware (regulator and transducer) settings
 - User settings
 - Program selection and/or program calibration
 - File import and file/data export
 - Counters and test results clearing

HELP MENUS

- On-screen description of parameters below each variable
- QR codes allow smartphone scan to access and download information details

TEST STATUS/RESULT INDICATORS WITH REJECT ALARM

- In Test, Accept and Reject indications via HMI
- Onboard audible alarm with menu adjustable volume

COMPACT ENCLOSURE DESIGN

- Power, communication, air supply and test port connections are located on the rear