Overview
The Plug and Play Sensor Development Kit is a complete system for evaluating, using, and developing IEEE P1451.4 technology for self-identifying plug and play sensors. The IEEE P1451.4 is a draft standard for adding sensor parameter information in a transducer electronic data sheet (TEDS) stored in an EEPROM that resides in the sensor. IEEE P1451.4 smart TEDS sensors provide both an analog signal for traditional measurement, along with a serial digital link for accessing the TEDS information for plug and play operation.

The Plug and Play Sensor Development Kit contains all the software and hardware components required to access Transducer Electronic Data Sheets (TEDS) embedded in smart sensors, condition and acquire the analog signal from smart TEDS sensors, modify and edit TEDS data, and download TEDS to a variety of smart TEDS sensors.

Smart TEDS Connectivity
The Plug and Play Sensor Development Kit includes the software and hardware for interfacing both the analog and digital portions of smart TEDS sensors. The development kit comes with the ability to condition and acquire the following types of smart TEDS sensors:
- IEPE constant-current powered accelerometers and microphones
- Bridge (mV/V) sensors
- RTD and resistive (up to 400 Ω) sensors
- Amplified sensors with voltage outputs
- Thermocouples and millivolt output sensors
- IEEE P1451.4 digital protocol for TEDS interface
- Prewired sensor connectors for easy plug and play
- Uses standard IEEE transducer templates

The Plug and Play Sensor Development Kit includes interfaces for two channels for each of these sensor types, complete with front panel connectors already wired for direct sensor connectivity.

Because the development kit is based on the modular SCC Series signal conditioning system, the system can be easily modified for additional sensor types and connectors.

SCC Signal Conditioning and DAQ System
Signal conditioning and acquisition of the analog sensor signals is provided by the SCC signal conditioning system used in conjunction with an E Series and basic multifunction data acquisition device. The SC-2345 is a carrier that houses up to eight SCC modules, which provide up to 16 channels of analog signal conditioning. The development kit includes the SC-2345 loaded with five SCC modules for voltage, bridge, IEPE (ICP), RTD, and thermocouples sensors. The analog signals, along with the digital TEDS information, are connected to a data acquisition device for acquisition into the computer. The development kit includes the PCI-6013, a 16-bit basic multifunction board for PCI. Alternative E Series products are available with PXI, PCMCIA and USB platforms.
IEEE P1451.4 TEDS Interface
The SC-2345 carrier contains SCC modules for accessing TEDS EEPROMs in smart TEDS sensors according to the protocols defined in the IEEE P1451.4 specification. The TEDS interface in the Plug and Play Sensor Development Kit works with both Class 1 and Class 2 sensor interfaces. IEPE (or ICP™) accelerometers and microphones with TEDS typically implement the Class 1 interface, which time-shares the analog and digital TEDS information on a single pair of signal wires. Most other types of sensors will implement the Class 2 interface, which defines a separate and independent connection for the TEDS communication. The development kit can be used for up to eight Class 1 interfaces and up to 16 Class 2 interfaces.

LabVIEW TEDS Software
The TEDS Library for LabVIEW is included with the development kit. This library performs the basic parsing and editing of binary TEDS images according to the IEEE P1451.4 specification. The library includes a palette of VIs that:
• Convert binary TEDS into defined LabVIEW data types
• Access and decode specific TEDS parameters from the TEDS data
• Modify TEDS fields for downloading back into the sensor or into a Virtual TEDS file
This library is hardware independent, meaning you can use the TEDS Library VIs to access and process both Virtual TEDS files and TEDS uploaded from smart TEDS sensors with EEPROMs. The software also includes driver routines for both uploading and downloading TEDS data to smart TEDS sensors connected to the SCC system.

System Components
The Plug and Play Sensor Development Kit includes the following components:
• SC-2345 carrier for SCC signal conditioning modules
• SCC modules
  - SCC-ICP01
  - SCC-SG04
  - SCC-RTD01
  - SCC-FT01
  - SCC-TC02
• SCC connector panelettes, wired to SCC modules
• PCI-6013 16-bit basic multifunction data acquisition board (200 kS/s, 16-bit, 16 analog inputs)
• R6868 ribbon cable to connect the PCI-6013 to the SC-2345 unit
• TEDS library for LabVIEW
• TEDS/SCC interface driver for LabVIEW
• 2 mating sensor connectors with built-in TEDS memory component

<table>
<thead>
<tr>
<th>Smart TEDS Sensor Type</th>
<th>Number of Channels</th>
<th>IEEE TEDS Interface</th>
<th>Connector (on SC-2345)</th>
<th>SCC Module Applicable</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEPE (ICP™)</td>
<td>2</td>
<td>Class 1</td>
<td>BNC</td>
<td>SCC-ICP1 (2)</td>
<td>AC-coupled ICP interface</td>
</tr>
<tr>
<td>Bridge (mV/V)</td>
<td>2</td>
<td>Class 2</td>
<td>9-pin D-Sub, male</td>
<td>SCC-SG04</td>
<td>Bridge transducers and full-bridge strain measurements; 2.5 V excitation</td>
</tr>
<tr>
<td>Voltage (±10V)</td>
<td>2</td>
<td>Class 2</td>
<td>9-pin D-Sub, female</td>
<td>SCC-FT01</td>
<td>Supplies ±15 VDC and 5 VDC power for amplified sensors</td>
</tr>
<tr>
<td>RTD/resistive</td>
<td>1*</td>
<td>Class 2</td>
<td>6-pin LEMO, female</td>
<td>SCC-RTD01</td>
<td>Standard RTDs and resistive sensors up to 400 Ω</td>
</tr>
<tr>
<td>Thermocouples and millivolts (±100 mV)</td>
<td>1</td>
<td>Class 2</td>
<td>Screw terminals (4)</td>
<td>SCC-TC02</td>
<td>Cold-junction compensation sensor, gain and filtering</td>
</tr>
</tbody>
</table>

*The SCC-RTD01 includes two channels of sensor conditioning; however, the development kit utilizes only one channel.
## Typical Specifications

### Bridge Input
- **Number of channels**: 2 differential
- **SCC module**: SCC-SG04
- **Input signal range, maximum**: ±100 mV (±40 mV/V)
- **Excitation voltage**: ±10 V
- **Excitation current source**: 1 mA ±0.04%
- **Max voltage level without losing regulation**: 24 V
- **Filtering**: Lowpass 3-pole Sallen and Key filter (-3 dB at 30 Hz)
- **TEDS interface**: Class 2
- **Sensor connector**: 9-pin female D-Sub

### ICP Accelerometer Input
- **Number of channels**: 2 differential
- **SCC module**: SCC-ICP01 (two modules)
- **Input signal range**: ±5 V
- **Constant-current source**: 4 mA
- **Max voltage level without losing regulation**: 24 V
- **Input coupling**: AC (-3dB at 0.8 Hz)
- **Filtering**: Lowpass 3-pole Bessel (-3 dB at 19 kHz)
- **TEDS interface**: Class 1
- **Sensor connector**: BNC

### Voltage Input
- **Number of channels**: 2 differential
- **SCC module used**: SCC-FT01
- **Input signal range**: ±10 V
- **Input impedance (powered on)**: 100 GΩ in parallel with 100 pF
- **Power supply source**: ±5 VDC
- **Filtering**: Lowpass 3-pole Sallen and Key filter (-3 dB at 30 Hz)
- **TEDS interface**: Class 2
- **Sensor connector**: 9-pin female D-Sub

### RTD/Resistive Input
- **Number of channels**: 1 differential
- **SCC module**: SCC-RTD01
- **Input signal range**: ±40 mVDC
- **Excitation current source**: 1 mA ±0.04%
- **Max voltage level without losing regulation**: 24 V
- **Filtering**: Lowpass 3-pole Sallen and Key filter (-3 dB at 30 Hz)
- **TEDS interface**: Class 2
- **Sensor connector**: 6-pin female LEMO (B Series)

### Millivolt/Thermocouple Input
- **Number of channels**: 1 differential
- **SCC module**: SCC-TC02
- **Input signal range**: ±100 mV
- **Input impedance**: 10 MΩ
- **Cold-junction sensor**: Located in SCC-TC01; output routed to AI channel
- **Filtering**: 2 Hz, dual-pole RC filter
- **TEDS interface**: Class 2
- **Sensor connector**: 4 screw terminals

### Data Acquisition Capabilities (PCI-6013)
- **Number of analog input channels**: 16 single-ended or 8 differential
- **Resolution**: 16 bits, 1 in 65,536
- **Maximum sampling rate**: 200 kS/s
- **Input signal ranges**: ±100 mV to ±10 V
- **Analog outputs**: 2 channels, 16-bits, ±10 V
- **Digital I/O**: 4 input/output, TTL (4 additional DIO lines reserved for TEDs communication)
- **Counter/timers**: 2, 24-bit, 20 MHz counter/timers
- **Connector**: 68-pin male SCSI-II type
- **Cable to SCC System**: 68-pin to 68-pin ribbon cable

### System Specifications
- **TEDS interface**: IEEE P1451.4, Class 1 and Class 2
- **TEDS EEPROM device compatibility**: Maxim/Dallas Semiconductor DS2430 and DS2433 device families
- **Power (with SCC-PWR01)**: +5 VDC from PCI-6013, or external source
- **SC-2345 physical dimensions**: 30.7 by 25.4 by 4.3 cm (12.1 by 10 by 1.7 in)
- **Environmental, operating temperature**: 0 to 50 °C
- **Environmental, relative humidity**: 10 to 90% noncondensing
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