B2900C / CL Series Precision Source / Measure Unit

Cost-Effective Source / Measurement Solutions Offer Superior Performance

Introduction

The Keysight B2900C / CL Series Source/Measure Unit (SMU) series contains the following six models.

- B2901CL Precision Source / Measure Unit, 1 ch, 1pA resolution, 21 V, 1.5 A
- B2910CL Precision Source / Measure Unit, 1 ch, 10fA resolution, 210 V, 1.5 A
- B2901C Precision Source / Measure Unit, 1 ch, 100fA resolution, 210 V, 3A DC / 10.5 A pulse
- B2902C Precision Source / Measure Unit, 2 ch, 100fA resolution, 210 V, 3A DC / 10.5 A pulse
- B2911C Precision Source / Measure Unit, 1 ch, 10fA resolution, 210 V, 3A DC / 10.5 A pulse
- B2912C Precision Source / Measure Unit, 2 ch, 10fA resolution, 210 V, 3A DC / 10.5 A pulse

This configuration guide provides step-by-step instructions for configuring an SMU and its related accessories to meet specific test requirements. For detailed specifications, refer to the B2900C/CL SMU series datasheet.

KEYSIGHT

Step 1. Select the B2900C / CL Series Model

There are two key parameters you need to select up-front: the number of measurement channels (one or two) and the SMU performance level. The B2900C / CL series comes in variants:

- **Value** (B2901CL / B2910CL)
- **Standard** (B2901C / B2902C)
- **High-performance** (B2911C / B2912C)

Note: SMUs cannot be upgraded to add more channels or switch to a different version after purchase.

Product Number	Number of Channels	Max Output DC	Max Output Pulse	Min Source Resolution	Min Measure Resolution	Min Timing Interval	Viewing Mode
B2901CL	1	21 V 1.5 A	N/A	10 pA 1 µV	1 pA 100 nV	200 µs	Single, graph
B2910CL	1	210 V 1.5 A	N/A	100 fA 1 µV	10 fA 100 nV	50 µs	Single, graph
B2901C	1	210 V 3.03 A	200 V 10.5 A	1 pA 1 µV	100 fA 100 nV	20 µs	Single, graph
B2902C	2	210 V 3.03 A	200 V 10.5 A	1 pA 1 µV	100 fA 100 nV	20 µs	Single, dual, graph
B2911C	1	210 V 3.03 A	200 V 10.5 A	10 fA 100 nV	10 fA 100 nV	10 µs	Single, graph, roll
B2912C	2	210 V 3.03 A	200 V 10.5 A	10 fA 100 nV	10 fA 100 nV	10 µs	Single, dual, graph, roll

Each B2900C / CL series SMU supplies the following standard items:

Description	Qty	Additional Information
Quick Reference	1 ea	Printed reference for quick startup (English)
Certificate of Calibration (without test data)	1 ea	Certificate of calibration (without actual test data). If you need the test data, please specify option UK6.
USB cable	1 ea	USB cable (1.8 m). The orderable parts number is 8121-1696.

Step 2. Select Optional Accessories

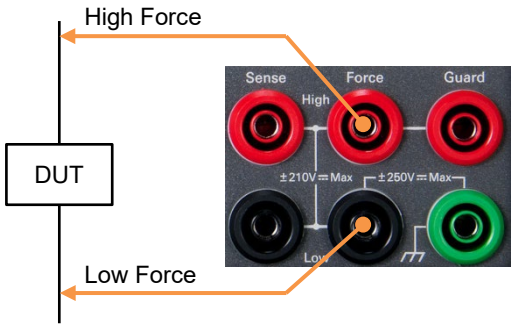
Step 2-1. Add Rack Mount Kit (Optional)

Description	Product Number	Additional Information
Rack Mount Kit	1CM124A	It includes a rack mount flange and front handle kit. It fits a standard 19-inch rack and occupies two units of rack space.

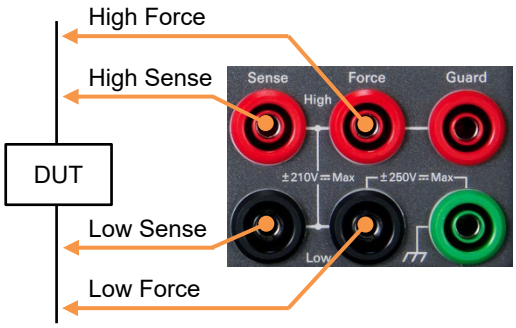
Step 2-2. Determine if You Need to Make 4-Wire or Guarded Measurements

The B2900C/CL SMUs support both 2-wire and 4-wire measurement. The default connection scheme is the more straightforward 2-wire configuration, which uses only the force terminals. In 2-wire mode, the sense terminals are left open.

If you are measuring very small resistances or applying very large currents, use the 4-wire measurement method (also known as the Kelvin method). This technique employs both the force and sense terminals. By measuring the sense terminals, where no current flows, it effectively eliminates the effects of cable resistance.



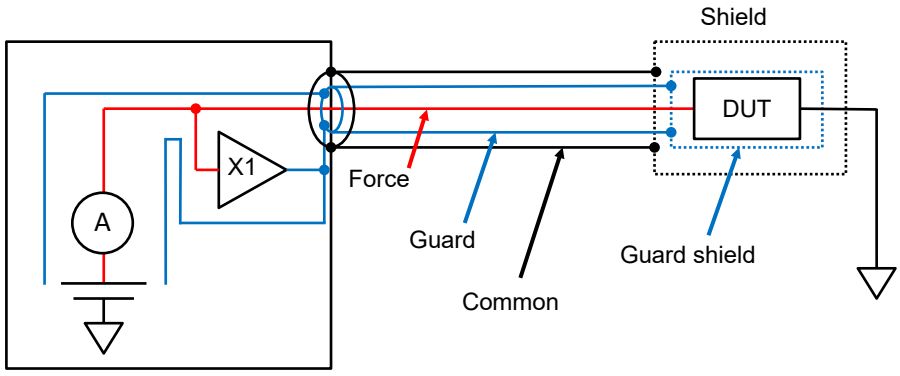
2-wire connections



4-wire connections

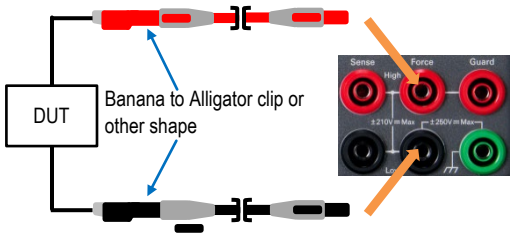
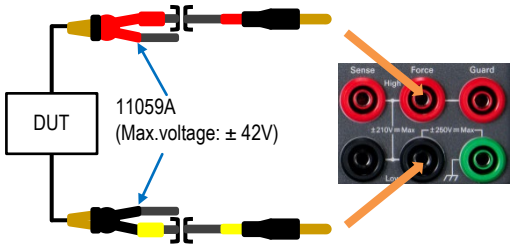
Low current measurements (< 1 nA) require guarding to prevent leakage through the measurement cable. The schematic shown below provides a simplified overview of the guarding technique. Guarded measurements require the use of triaxial cables. A follower (x1) buffer amplifier keeps the guard conductor at the same potential as the center conductor. Since there is no voltage difference, no current can flow from the center conductor to the guard.

Note: In this example, even the test fixture has a guarded shield to prevent leakage at the test fixture.

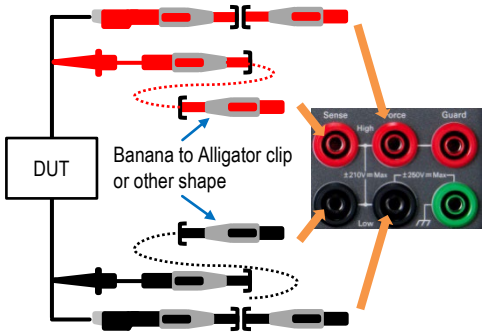
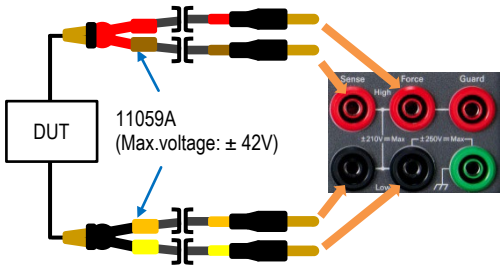


Guarding technique

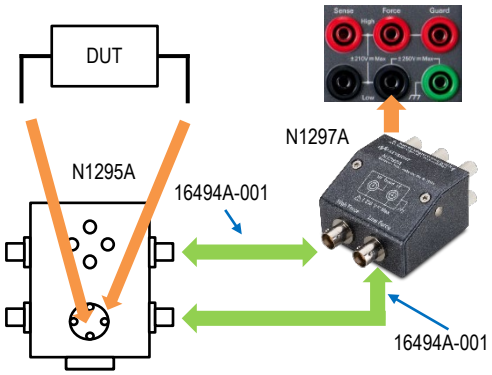
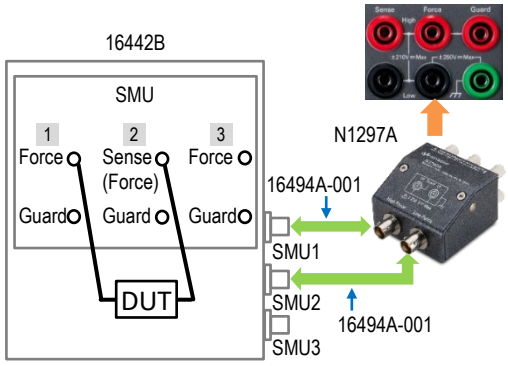
1. Unguarded 2-Wire Connection Scheme

Typical Connection Example	Product Number	Qty.	Description
Recommended connection 	NA – Prepare Banana (Instrument side) to Alligator clip or other shape (DUT side), ensuring that the ratings meet your needs.	2 ea for High Force and Low Force	
Easy connection Note: The 11059A simplifies connectivity but does not support voltage magnitudes greater than ± 42 V. 	11059A	1 ea	Kelvin probe set

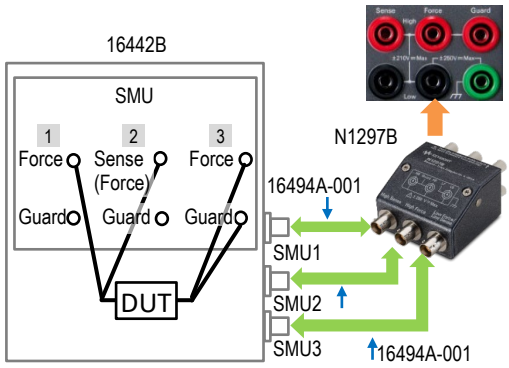
2. Unguarded 4-Wire Connection Scheme

Typical Connection Example	Product Number	Qty.	Description
Recommended connection 	NA – Prepare Banana (Instrument side) to Alligator clip or other shape (DUT side), ensuring that the ratings meet your needs.	4 ea for High Force, High Sense, Low Force, and Low Sense	
Easy connection Note: The 11059A simplifies connectivity but does not support voltage magnitudes greater than ± 42 V. 	11059A	1 ea	Kelvin probe set

3. Guarded 2-Wire Connection Scheme

Typical Connection Example	Product Number	Qty.	Description
Recommended connection Note: The N1295A does not support voltages greater than ± 42 V. 	16494A-001 N1297A N1295A	2 ea 1 ea 1 ea	Low leakage Triaxial cable (1.5 m) Banana - Triaxial Adapter for 2-wire (non-Kelvin) connection Device/component test fixture
Recommended connection Note: The 16442B supports voltages up to 200 V. 	16494A-001 N1297A 16442B	2 ea 1 ea 1 ea	Low leakage Triaxial cable (1.5 m) Banana - Triaxial Adapter for 2-wire (non-Kelvin) connection Test Fixture for general use

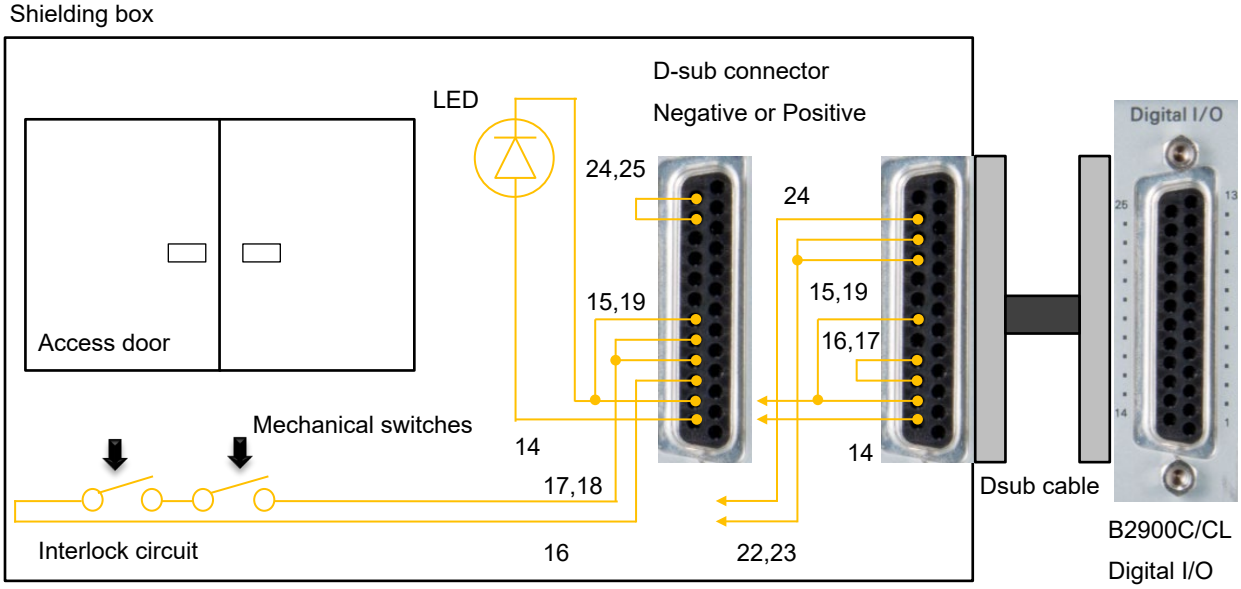
4. Guarded 4-Wire Connection Scheme

Typical Connection Example	Product Number	Qty.	Description
Recommended connection 	16494A-001 N1297B 16442B	3 ea 1 ea 1 ea	Low leakage Triaxial cable (1.5 m) Banana - Triaxial Adapter for 4-wire (Kelvin) connection Test Fixture for general use

Step 2-3. Consider Interlock Circuit (Optional)

The SMUs have a safety interlock to prevent accidental exposure to dangerously high voltages. Voltages greater than ±42 V cannot be sourced unless the interlock circuit is closed. This function is accomplished through the use of pins 16 and 24 on the rear Digital I/O output. Typically, these pins are routed to a shielding box or test fixture that must be closed to complete the interlock circuit.

If you are using the 16442B test fixture, you can connect to the interlock circuit using the N1294A-011 or 012 interlock cables. If you are not using the 16442B, you should install an interlock circuit, as shown in the figure below. For more detailed information, please refer to “Installing the Interlock Circuit” in the Keysight B2900C / CL Series User’s Guide.



Description	Product Number	Additional Information
Interlock cable (1.5 m)	N1294A-011	Interlock cable for 16442A/B test fixture (GPIO Dsub25 to 6pin mini plug)
Interlock cable (3.0 m)	N1294A-012	

Step 2-4. Determine if You Need to Use the B2900C / CL Series with Multiple Software Control Options (Optional)

The series has multiple software control options, allowing you to select the solution that best fits your application needs.

Software Control Option	Available Interface	Description
Pathwave BenchVue	GPIB, USB, LAN	Source constant voltage or current and control other Keysight instruments
Graphical web interface	LAN	Use your web browser to make basic measurements
PathWave IV curve software	GPIB, USB, LAN	A common software solution for the entire B2900 family
EasyEXPERT group+	GPIB	Powerful software for detailed characterization and analysis of devices, circuits, and materials

- 82357B GPIB-USB Interface is necessary for software control through the GPIB interface.
- A 1.8-meter USB cable with the B2900C / CL series is provided for software control via a USB interface.
- A LAN cable is necessary for software control through the LAN interface.
- The EasyEXPERT group+ software supports multiple unit control with synchronization. Please see the following page for more details.

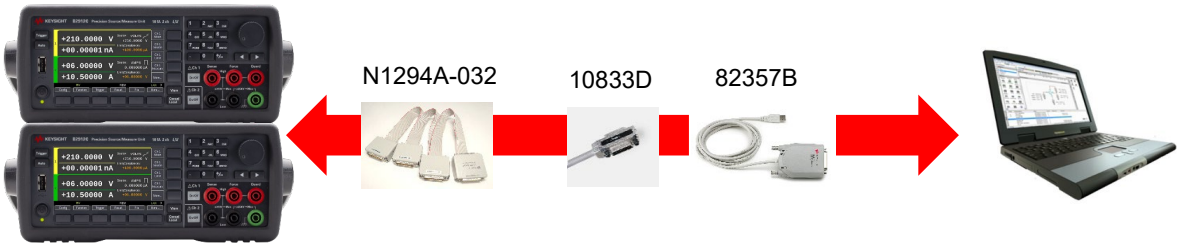
Step 2-5. Determine if You Need to Use the B2900C / CL SMUs with EasyEXPERT group+ Software

The EasyEXPERT group+ software can control up to 4 units of the B2900C/CL SMUs simultaneously. When using multiple units of the B2900C / CL SMUs with the EasyEXPERT group+ software, you must connect trigger lines to synchronize one unit with the others. A USB or LAN connection is also available instead of GPIB.

1. Use a Single Unit of the B2900C/CL SMU

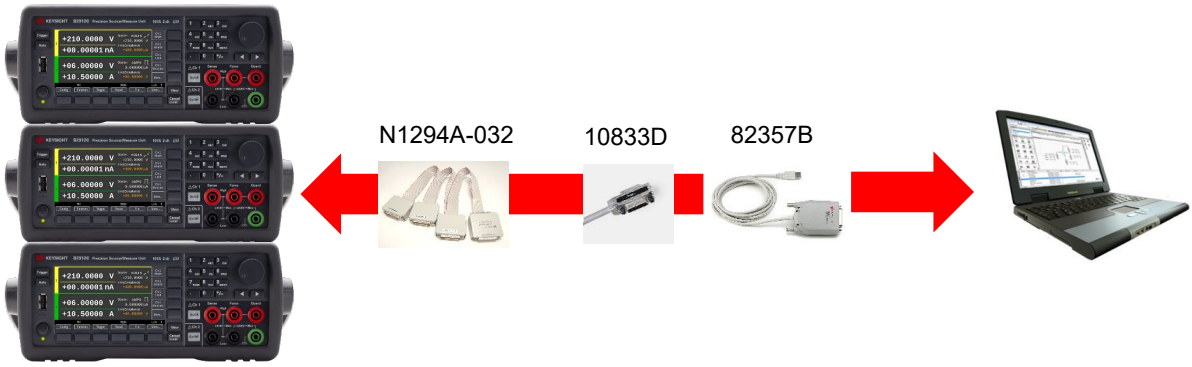
Product Number	Qty.	Description
B2900C/CL	1 ea	Precision source/Measure unit
82357B	1 ea	USB / GPIB interface

2. Use Two Units of the B2900C/CL SMU



Product Number	Qty.	Description
B2900C/CL	2 ea	Precision source / Measure unit
82357B	1 ea	USB / GPIB interface
N1294A-032	1 ea	Digital I/O trigger cable for multiple unit control
10833D	1 ea	GPIB cable (0.5 m)

3. Use Three Units of the B2900C / CL SMU



Product Number	Qty.	Description
B2900C/CL	3 ea	Precision source / Measure unit
82357B	1 ea	USB / GPIB interface
N1294A-032	1 ea	Digital I/O trigger cable for multiple unit control
10833D	2 ea	GPIB cable (0.5 m)

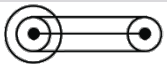
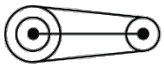
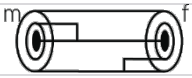
4. Use Four Units of the B2900C/CL SMU

Product Number	Qty.	Description
B2900C/CL	4 ea	Precision source / Measure unit
82357B	1 ea	USB / GPIB interface
N1294A-032	1 ea	Digital I/O trigger cable for multiple unit control
10833D	3 ea	GPIB cable (0.5 m)

The EasyEXPERT group+ software manuals (User's guide) are available for download from www.keysight.com/find/easyexpert.

Step 2-6. Select Additional Accessories (Optional)

The following optional accessories are available for specialized requirements.

Description	Product Number	Additional Information
Low leakage Triaxial cable (1.5 m)	16494A-001	16494A triaxial cable supports up to 200 V and 1 A.
Low leakage Triaxial cable (3.0 m)	16494A-002	
Low leakage Triaxial cable (0.8 m)	16494A-003	
Low leakage Triaxial cable (0.4 m)	16494A-004	
Low leakage Triaxial cable (4.0 m)	16494A-005	
High current Triaxial cable (1.5m)	16493L-001	16493L triaxial cable supports a current higher than 1 A.
High current Triaxial cable (3.0m)	16493L-002	
Coax cable (1.5 m)	16493B-001	16493B coax cable supports up to 40 V and 200 mA.
Coax cable (3.0 m)	16493B-002	
High current BNC Coax cable (1.5 m)	16493U-001	16493U coax cable supports up to 40 V and 20 A pulse.
High current BNC Coax cable (3.0 m)	16493U-002	
Coaxial BNC cable (1.2 m)	U2921A-100	
Kelvin probe set	11059A	
Triaxial(m) to BNC (f) adaptor	N1254A-101	
Triaxial(f) to BNC (m) adaptor	N1254A-102	
Triaxial(m) to BNC (f) adaptor	N1254A-103	
Triaxial (f) to BNC (m) adaptor	N1254A-104	
Triaxial (f) to BNC (m) adaptor	N1254A-105	
Triaxial (m) to BNC (f) adaptor	N1254A-106	
Triaxial (m) to Triaxial (f) adaptor	N1254A-107	
Coax tee adapter (m-f-f)	1250-2405	
Triaxial tee adapter (f-m-f)	1250-1551	
Digital I/O cable (1.5 m)	16493G-001	To synchronize triggering between members of the B2900C/CL Series
Digital I/O cable (3.0 m)	16493G-002	
Digital I/O T-cable	N1253A-100	To synchronize triggering between members of the B2900C/CL Series
Interlock cable (1.5 m)	N1294A-011	Interlock cable for the 16442A/B test fixture (GPIO Dsub-25 to 6-pin mini plug)
Interlock cable (3.0 m)	N1294A-012	
GPIO - BNC trigger adapter	N1294A-031	
Digital I/O trigger cable for multiple unit control	N1294A-032	Required to use EasyEXPERT group+ software with multiple units
USB A-BI-O cable (2.0 m)	8121-1696	USB A-B I-O cable
USB / GPIB interface	82357B	
Banana - Triaxial adapter for 2-wire (non-Kelvin) connection	N1297A	
Banana - Triaxial adapter for 4-wire (Kelvin) connection	N1297B	
Device/component test fixture	N1295A	
Test fixture for E5270 and general use	16442B	
GPIB cable (1.0 m)	10833A	
GPIB cable (2.0 m)	10833B	
GPIB cable (4.0 m)	10833C	
GPIB cable (0.5 m)	10833D	

Step 3. Select Warranty Duration and Calibration Plan (Optional)

Keysight provides factory calibration as standard and free of additional charges.

Description	Product Number	Additional Information
Calibration + uncertainties + guard banding (not accredited)	B2901CL-1A7	Calibration certificate with measurement results available only at the time of purchase
	B2910CL-1A7	
	B2901C -1A7	
	B2902C -1A7	
	B2911C -1A7	
	B2912C -1A7	
ANSI Z540-1-1994 calibration	B2901CL-A6J	Calibration certificate with measurement results available only at the time of purchase
	B2910CL-A6J	
	B2901C -A6J	
	B2902C -A6J	
	B2911C -A6J	
	B2912C -A6J	
Commercial calibration certificate with test data	B2901CL-UK6	Calibration certificate with measurement results available only at the time of purchase
	B2910CL-UK6	
	B2901C -UK6	
	B2902C -UK6	
	B2911C -UK6	
	B2912C -UK6	
Calibration plan — return to Keysight — 3 years	R-50C-011-3	
Calibration plan — return to Keysight — 5 years	R-50C-011-5	

Software Upgrade Package for B2900C / CL Series

If you do not have the license for the EasyEXPERT group+ software or the latest GUI functions with your existing B2900C/CL Series, a product update may be necessary. For further information, please contact Keysight.

Description	Product Number	Additional Information
B2901CL software upgrade package	B2901CLU	Extension support and subscription
B2910CL software upgrade package	B2910CLU	
B2901C software upgrade package	B2901CU	
B2902C software upgrade package	B2902CU	
B2911C software upgrade package	B2911CU	
B2912C software upgrade package	B2912CU	