

RFI/EMI CURRENT PROBES AND INJECTION PROBES



CURRENT PROBES

Current probes required by various EMI specifications (such as MIL-STD-461/2) are toroidal transformers designed to measure r.f. currents on active power lines or other conductors.

APPLICATION

A current probe is used as a “pick-up” device for measuring r.f. current in single conductors or cable bundles when connected to the 50 ohm input of a radio frequency interference measuring receiver or spectrum analyzer.

DESCRIPTION

Direct connection to the conductor carrying EMI current is not necessary, since the probe may be opened for insertion of the conductor into the window of the toroid and then closed again to form a toroidal transformer with the conductor acting as a one-turn primary.

A correction factor graph is provided to convert measured microvolts to EMI microamperes. When the EMI current is measured in dB above one microvolt as indicated on a conventional EMI

meter, the correction factor will convert the measurement to dB above one microampere. The correction factor is the inverse of the transfer impedance, Z_t . Each probe is shipped with a graph of the correction factor versus frequency, keyed to the serial number on the probe.

Under certain conditions, a current probe can be used to inject *low level* r.f. signals into individual wires or cable bundles. Ask our engineers for advice in the use of current probes for this purpose. Some current probes can be easily damaged or are otherwise unsuitable for this application.

INJECTION PROBES

Specifications require the injection of large high frequency currents into cable bundles and individual wires, using inserted secondary toroidal transformers placed around the conductors being tested.

APPLICATION

High power r.f. amplifiers with 50 ohm output impedance are used to deliver voltage to the injection probe. The wire or cable through the window of the probe acts as a secondary of the toroidal transformers. This test method is intended to be used instead of earlier methods, such as CS-01, CS-02, and RS-02 of MIL-STD-461.

DESCRIPTION

Bulk Current Injection Probes are available in two styles:

1. Fixed window style where the wire(s) under test must be passed through the window.
2. A split toroidal design where the probe can be opened up and clamped over the wire(s) under test.

Each probe is calibrated for insertion loss and transfer impedance in a test fixture designed for the particular window size. This fixture provides a signal path with a low Voltage Standing Wave Ratio. A typical fixture is **Solar Type 9125-1**, used for probes with 32 to 44 mm diameter windows. Ask for details on this and other test fixtures.

Injection probes available at the time of this printing are described later in this section. Development of new styles is ongoing. If a probe meeting your requirements is not found on the list, send us details and we will satisfy your need.

TECHNICAL INFORMATION

Current probes used as receptors are known as “inserted primary toroidal transformers” for connection to EMI receivers. **Injection probes** which deliver high r.f. currents into wires through the window are called “inserted secondary toroidal transformers”.

The maximum voltage carried on wires through the window is limited only by the insulation of



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CURRENT PROBES AND INJECTION PROBES (cont.)

the wires. Maximum primary current in the wires through the window of **current probes** is listed on the table below (symbol Ip).

The signal input to **injection probes** is rated in watts from the signal source as indicated in the table on the following page.

Development is continuing on new and useful probes, both current measuring "sensor" probes and high wattage injection probes. The following is a partial list. As time goes on, the list will grow. If you do not see what you need, just ask.

CLAMP-ON CURRENT PROBES				MAXIMUM PRI. (Ip) CURRENT, AMPS			FREQUENCY RANGE
SOLAR TYPE NO.	WINDOW DIAMETER	NOMINAL Z _T OHMS	DC to 60 Hz	400 Hz	RF (CW)	PULSE	
9124-1N	1.25" (32.0 mm)	0.001	200	70	50	5000	1 KHz -200 MHz
9204-1	1.25" (32.0 mm)	0.33	350	350	50	100	1 KHz - 8 MHz
9205-1	1.25" (32.0 mm)	0.33	800	800	50	100	20 Hz - 8 MHz
9118-1	1.25" (32.0 mm)	0.10	350	150	22	500	500 Hz -200 MHz
9134-1	1.25" (32.0 mm)	0.70	500	400	5	100	20 Hz -100 MHz
6741-1	1.25" (32.0 mm)	0.70	350	225	5	100	10 KHz -100 MHz
9206-1	1.25" (32.0 mm)	1.0	350	350	4.2	100	10 KHz -150 MHz
9207-1	1.25" (32.0 mm)	1.0	800	450	4.2	100	20 Hz -150 MHz
9208-1	1.25" (32.0 mm)	1.0	350	350	100	200	10 KHz - 30 MHz
9209-1	1.25" (32.0 mm)	1.0	800	800	100	200	20 Hz - 30 MHz
9145-1	1.25" (32.0 mm)	5	350	350	42	100	10 KHz -150 MHz
9119-1N	1.25" (32.0 mm)	1-7	200	200	40	70	1 MHz- 1.2 GHz
9123-1N	1.25" (32.0 mm)	1-5	200	200	40	60	10 KHz -500 MHz
9115-1N	1.25" (32.0 mm)	10	250	250	50	100	3 MHz-200 MHz
9214-1	1.25" (32.0 mm)	5	600	600	21	200	20 Hz -150 MHz
9215-1N	1.25" (32.0 mm)	1-5	400	350	40	100	20 Hz -500 MHz
9231-1	1.25" (32.0 mm)	.010	300	200	7	3000	1 KHz -200 MHz
9219-1N	1.25" (32.0 mm)	.025	400	300	150	200	20 Hz - 20 MHz
9242-1	1.25" (32.0 mm)	.025	400	80	35	100	20 Hz - 20 MHz
9250-1N	1.25" (32.0 mm)	.10	200	200	10	200	10 KHz -450 MHz
9136-1N	2.62" (67.0 mm)	5	350	350	100	200	10 KHz -100 MHz
9249-1N	2.62" (67.0 mm)	8	350	350	60	200	10 KHz -300 MHz
9256-1N	2.62" (67.0 mm)	2	350	350	200	200	10 KHz - 30 MHz
9257-1N	2.62" (67.0 mm)	2	500	500	200	200	20 Hz - 30 MHz
9258-1N	2.62" (67.0 mm)	5	500	500	100	200	20 Hz -100 MHz
9260-1N	2.62" (67.0 mm)	2	350	75	2.6	100	10 KHz -200 MHz

(continued on next page)



CURRENT PROBES AND INJECTION PROBES (cont.)

CLAMP-ON CURRENT PROBES (continued)				MAXIMUM PRI. (I _p) CURRENT, AMPS			FREQUENCY RANGE
SOLAR TYPE NO.	WINDOW DIAMETER	NOMINAL Z _T OHMS	DC to 60 Hz	400 Hz	RF (CW)	PULSE	
9261-1N	2.62" (67.0 mm)	2	500	500	2.6	100	20 Hz -200 MHz
9262-1N	2.62" (67.0 mm)	.03	350	150	80	200	100 KHz - 100MHz
9263-1N	2.62" (67.0 mm)	.3	500	500	80	200	20 Hz -100 MHz
9301-1N	2.62" (67.0 mm)	8	500	500	60	200	20 Hz -500 MHz
9302-1N	2.62" (67.0 mm)	.001	400	70	100	500	20 Hz -100 MHz
9303-1N	2.62" (67.0 mm)	.001	500	200	100	5000	20 Hz -100 MHz
9304-1N	2.62" (67.0 mm)	1	350	350	2.3	200	10 KHz-200 MHz
9305-1N	2.62" (67.0 mm)	1	500	500	2.3	200	20 Hz -200 MHz
9306-1N	2.62" (67.0 mm)	.005	200	65	60	5000	10 KHz-100 MHz
9307-1N	2.62" (67.0 mm)	.005	300	300	60	5000	20 Hz -100 MHz
9308-1N	2.62" (67.0 mm)	.01	300	75	17	2000	10 KHz-200 MHz
9309-1N	2.62" (67.0 mm)	.01	450	450	17	2000	20 Hz -200 MHz

FIXED WINDOW PROBES				MAXIMUM PRI. (I _p) CURRENT, AMPS			FREQUENCY RANGE
SOLAR TYPE NO.	WINDOW DIAMETER	NOMINAL Z _T OHMS	DC to 60 Hz	400 Hz	RF (CW)	PULSE	
9218-1	.50" (12.7 mm)	.1	10	10	8	100	10 KHz-250 MHz
9248-1	.50" (12.7 mm)	1	10	10	10	100	10 KHz - 50 MHz
9203-1	.50" (12.7 mm)	1	10	10	2.2	100	10 KHz-250 MHz
9211-1	.50" (12.7 mm)	.5-3	10	10	5	100	1 MHz- 1 GHz
9202-1	.50" (12.7 mm)	5	10	10	10	100	10 KHz-250 MHz
9246-1	.50" (12.7 mm)	.1	150	150	8	100	10 KHz-250 MHz
9253-1	.50" (12.7 mm)	1	150	150	65	100	20 Hz - 50 MHz
9245-1	.50" (12.7 mm)	1	150	150	3	100	10 KHz-300 MHz
9210-1	.50" (12.7 mm)	.3-5	150	150	16	100	300 KHz-500 MHz
9212-1	.50" (12.7 mm)	.3-4	150	150	30	100	1 MHz- 1 GHz
9244-1	.50" (12.7 mm)	5	150	150	13	100	10 KHz-600 MHz
9346-1	.50" (12.7 mm)	5	150	150	13	100	20 Hz -600 MHz

We provide equivalents for most Stoddart and Eaton probes.



CURRENT PROBES AND INJECTION PROBES (cont.)

We provide equivalents for most Stoddart and Eaton probes.

CLAMP-ON INJECTION PROBES								
SOLAR TYPE NO.	WINDOW DIAMETER	WINDING CURRENT	RATED WATTS	INSERTION LOSS				FREQUENCY RANGE
				UNDER 6 dB	UNDER 10 dB	UNDER 15 dB	UNDER 20 dB	
9108-1N	1.25" (32 mm)	10	50	—	—	120 KHz - 70 MHz	60 KHz - 150 MHz	10 KHz - 200 MHz
9120-1N	1.25" (32 mm)	30	50	—	12 MHz - 600 MHz	7 MHz - 900 MHz	4 MHz - 1GHz	4 MHz - 1 GHz
9121-1N	1.25" (32 mm)	30	50	—	100 MHz - 550 MHz	50 MHz - 800 MHz	30 MHz - 1GHz	10 MHz - 1 GHz
9142-1N	1.50" (38 mm)	50	200	10 MHz - 350 MHz	5 MHz - 430 MHz	2.5 MHz - 500 MHz	1.5 MHz - 500 MHz	2 MHz - 500 MHz
9144-1N	1.50" (38 mm)	26	100	—	200 KHz - 8 MHz	70 KHz - 90 MHz	40 KHz - 100 MHz	10 KHz - 100 MHz
9217-1N	1.50" (38 mm)	26	100	800 KHz - 1.5 MHz	500 KHz - 40 MHz	250 KHz - 100 MHz	150 KHz - 100 MHz	10 KHz - 100 MHz
9310-1N	2.62" (67 mm)	26	100	—	15 MHz - 450 MHz	800 MHz - 650 MHz	4 MHz - 800 MHz	5 MHz - 800 MHz
9607-1N	1.25" (32 mm)	10	50	—	500 KHz - 1 MHz	200 KHz - 30 MHz	120 KHz - 300 MHz	10 KHz - 300 MHz

Injection probes can also be used as current probes. A correction factor graph and instructions for its use are supplied.

CALIBRATION FIXTURES

Note: Except for p/n 9125-1 and 9357-1, the probes are supported and centered in the fixture.	
SOLAR PART NO.	DESCRIPTION
9125-1	For Injection Probes, 1.5" (32 mm - 44 mm) diameter window. 20 Hz to 500 MHz. Type BNC connectors.
9125-2	For Solar 9119-1N Probe and similar, 1.25" (32 mm) diameter window. 400 MHz to 3 GHz. Type N connectors.
9251-1	For Eaton, Stoddart and Solar Probes, 1.25" (32 mm) diameter window. 20 Hz to 500 MHz. Type BNC connectors.
9254-1	For Eaton, Stoddart and Solar Probes, 2.62" (66 mm) diameter window. 20 Hz to 500 MHz. Type N connectors.
9321-1	For Eaton, Stoddart and Solar Probes, 0.75" (19 mm) diameter window, totally enclosed. 20 Hz to 1.5 GHz. Type BNC connectors.
9330-1N	For Eaton, Stoddart and Solar Probes, 1.25" (32 mm) diameter window, totally enclosed. 20 Hz \approx 1.0 GHz. Type N connectors.
9357-1	Clam Shell Fixture for Solar 9335-2 Probe. 20 Hz to 100 MHz. Type BNC connectors.

