Manual

For Operation

RCB 200N1

Generation of transients by relay switching

According Ford EMC-CS-2009

This relay switching box has been designed by EM TEST to offer a high commodity for his customers testing according the new Ford specification.

Firmware: V2.02.01 or later

- Ford EMC-CS-2009.1

EM TEST (Switzerland) GmbH
Sternenhofstrasse 15
4153 Reinach BL1
Switzerland

Phone : +41 61 717 91 91
Fax : +41 61 717 91 99

URL : http://www.emtest.com

Contents

1. Standards covered by RCB 200N1

The RCB 200N1 is special designed for testing the Ford EMC-CS-2009 Standard. The hardware is built as specified in the normative Annex E of the Ford EMC-CS-2009.

Ford FMC1278

- CI-220	**Pulses :**	**A1, A2-1, A2-1 & C-1, A2-2 & C-2**
- RI-130	**Pulses :**	**A2-1, A2-2**

Ford EMC-CS-2009

- CI-220	**Pulses :**	**A1, A2-1, A2-1 & C-1, A2-2 & C-2**
- CI-260	**pulse :**	**F**
- RI-130	**Pulses :**	**A2-1, A2-2**

1.1. General

The RCB200N1 is an impulse generator who generates burst pulses using mechanical contacts. The pulses are generated by opening and closing the relays contacts (RLY1). Therefore the amplitude and waveform are random generated by the relays contact.
The randomness is additionally influenced by the choice of modes. With the pulse selection, the tendency of amplitude and wave shape will be influenced. This is done by different attenuation of the pulse generator and the tap at different locations in the circuit.
The DUT is connected internally depending on the pulse selection at different points in the circuit.

The RCB have been tested and approved by Ford Motor Company and found to be acceptable for use when performing EMC testing per EMC-CS-2009.

1.1.1. Basic circuit as per Ford Standard Ford FMC1278 and EMC-CS-2009

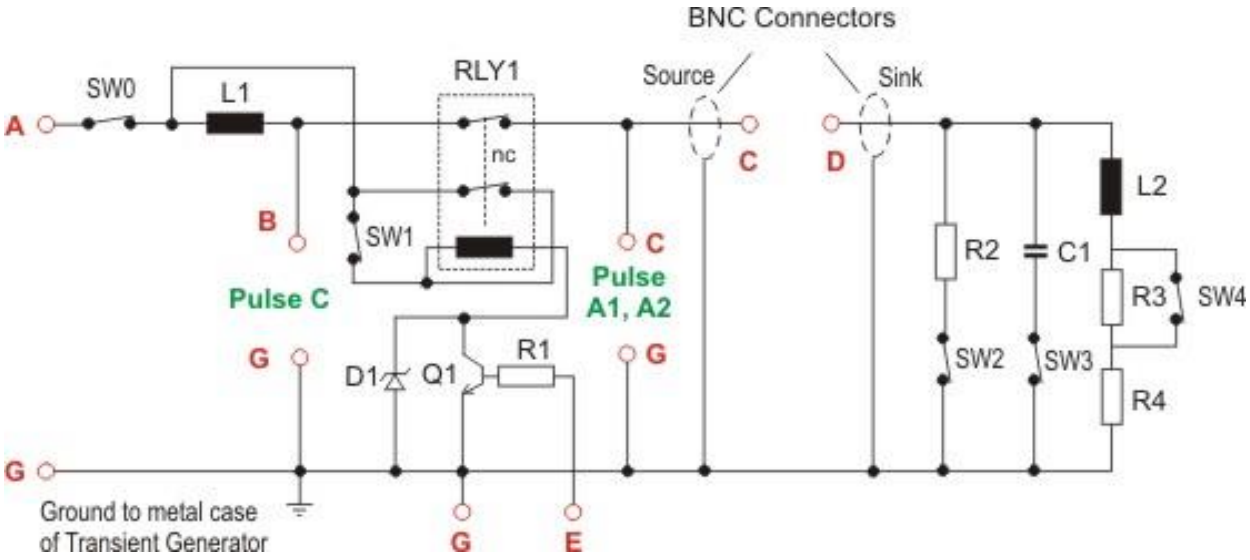


Figure 1.1: Transient Generator for RI130 and CI220 as per Ford FMC1278 and EMC-CS-2009

2. Operating Functions

2.1. Front view

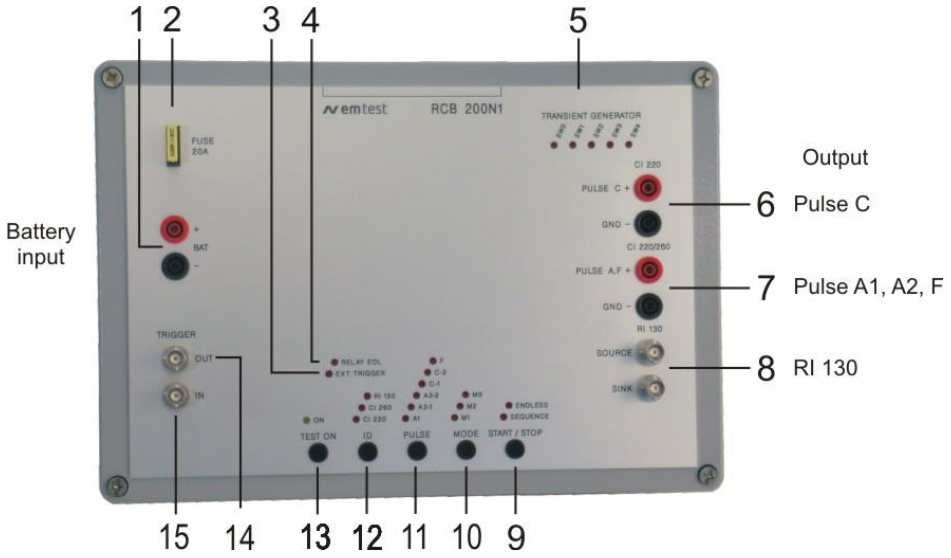


Figure 2.1

1. BAT input 13.5V (Power supply RCB 200N1)
2. Fuse 20A
3. Ext. Trigger mode
4. Indication Relays EOL (end of lifetime)
5. Transient Generator switching
6. Pulse C Output CI 220, CI 260
7. Pulse A, F Output CI 220, CI 260
8. Pulse Output RI 130 (BNC)
9. START / STOP ; LED endless / sequence
10. MODE selection
11. PULSE Transient pulse selection
12. ID Test selection
13. TEST ON
14. Internal Trigger OUT
15. Trigger IN

1 Battery input
Power supply input for RCB200N1 with 13.5V dc

2 Fuse
Fuse 20A for device protection

3 Ext. Trigger mode
Indication of external Trigger mode. The controller detect when the bridge between Trigger OUT – Trigger In is disconnected. In this Mode the user has to connect an external trigger signal for relays switching.

4 Relays EOL End of Lifetime indication
The lifetime of the Potter & Brumfield relays is limited by the erosion during the burst test. The operating duration is limited to 100hours.
- LED blinking: Lifetime is below 10 hour.
- LED on: The test will be stopped. The user must replace the relays.

5 Transient generator switch settings
Depend on the selected pulse the Ford standard recommends to set different switches. The LED indicates the internal relays setting according the Ford Standard

6 Pulse C output to DUT
Output plugs for testing pulses C-1 and C-2 as per CI 220

7 Pulse A, F output to DUT
Output plugs for testing pulses A1, A2-1, A2-2 and F as per CI 220 and CI 260

8 Pulse output to clamp
Output BNC plugs for testing as per RI 130. The BNC plugs are internal shorted when RI130 is not selected.

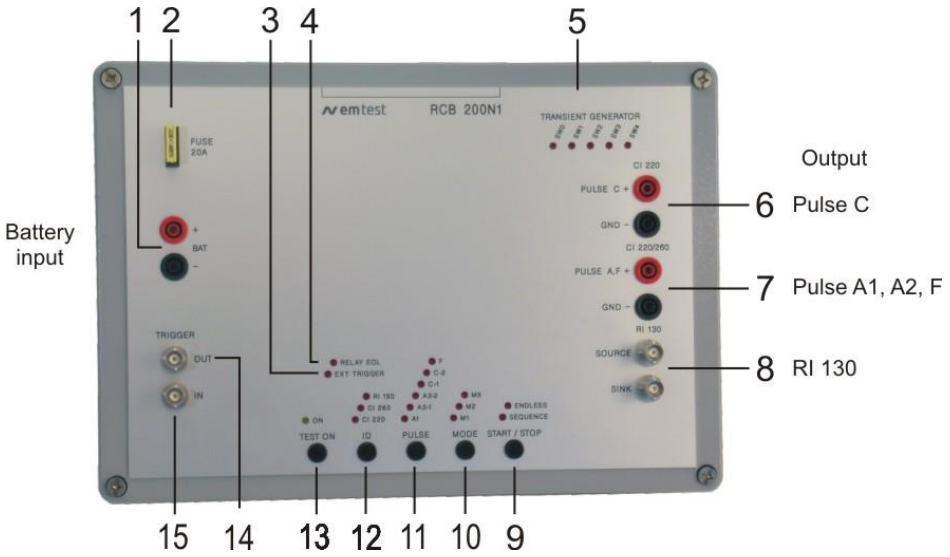


Figure 2.1

1. BAT input 13.5V (Power supply RCB 200N1)
2. Fuse 20A
3. Ext. Trigger mode
4. Indication Relays EOL (end of lifetime)
5. Transient Generator switching
6. Pulse C Output CI 220, CI 260 ; (B,G)
7. Pulse A, F Output CI 220, CI 260 (C,G)
8. Pulse Output RI 130 (BNC) (C,D)
9. START / STOP ; LED endless / sequence
10. MODE selection
11. PULSE Transient pulse selection
12. ID Test selection
13. TEST ON
14. Internal Trigger OUT
15. Trigger IN

9 START / STOP Button
Button for Start and Stop the test. The LED indicates the status.
- Sequence (Test in progress)
- Endless

10 MODE Button
Button for Mode selection depend the mode definition in Ford FMC1278 and EMC-CS-2009 standard

11 PULSE Button
Pulse selection with LED indication. Cyclic selection of test procedures A1, A2-1, A2-2, (C-1), C-2, F

12 ID Button
Button for test selection cyclic rotation of the tests CI220, CI 260, RI 130

13 TEST ON Button
Button for switch on/off the power to the DUT

14 Trigger OUT (BNC)
Trigger output from the internal controller unit

15 Trigger IN (BNC)
Trigger input (E) for relays 1 trigger. Max. trigger input voltage= 35V

3. Operation

3.1. Power supply

The Box is powered from the BAT input13.0V (+0.5V / -1.0V). The power supply to the DUT is fused with the 20A Fuse on the front panel.
The electronic is equipped with a reverse battery protection and will switch off automatically at approx. 18.5V overvoltage, for protect the internal parts from overload.

3.2. Test ON button

CI220 test

For CI 220 tests the TEST ON button will switch on the power to the DUT output plugs.
Press the button again will finish the test (SEQUENCE or ENDLESS) automatically and will return to STOP status.

RI 130 tests

During this test no DUT is connected to the DUT output plugs.
Therefore the TEST ON is inactive.

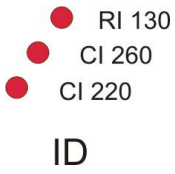
CI 260 tests

During this test DUTsupply voltage is switched as part of the test.
Therefore TEST ON is inactive.

3.3. ID, PULSE and MODE settings

The edit of the following functions is only in STOP mode possible.
With pressing the button the LED display increments to the next setting. A cyclic rotation indicates all possible settings of the selected test.

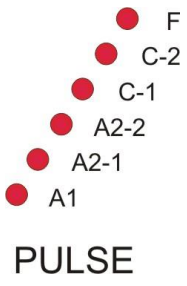
3.3.1. ID



Identity of the used test according Ford EMC-CS-2009 standard

RI 130 : Coupled Immunity
CI 220 : Immunity from Transient Disturbances
CI 260 : Immunity to Voltage Dropout

3.3.2. PULSE

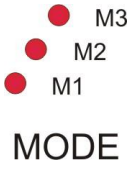


According to the selected ID, different Pulses are available.

Pulse application depends on the selected ID. The RCB 200N1 offers only the pulse applications, defined in the selected ID. The following pulse are offered:

CI 220: A1, A2-1, A2-1 & C-1 *(Mode 2 / 3)*, A2-2 & C-2
CI 260: F
RI 130: A2-1, A2-2

3.3.3. MODE



According to the selected ID and Pulse, different MODES are available.

CI 220	**A1**:	M1, M2
	A2-1:	M1
	A2-1 & C-1:	M2, M3
	A2-2 & C-2:	M2, M3
RI 130	**A2-1**:	M2, M3
	A2-2:	M2, M3

Mode 1

Represents a condition where the test pulse is applied at a repetition rate of 0.2 Hz with 10% duty cycle and 120s duration.

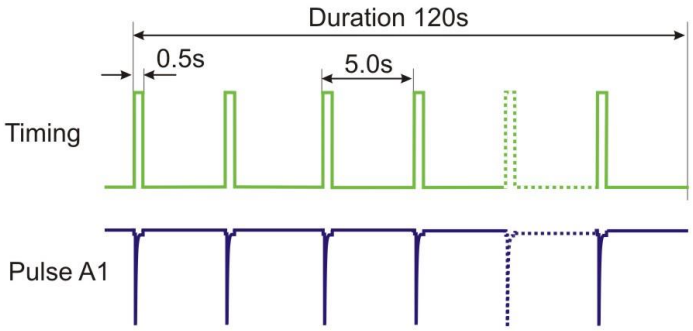


Figure 3.1 : Mode 1

Mode 2

Represents a condition where test pulses are applied using pseudorandom timing sequences. The time T is 50ms.

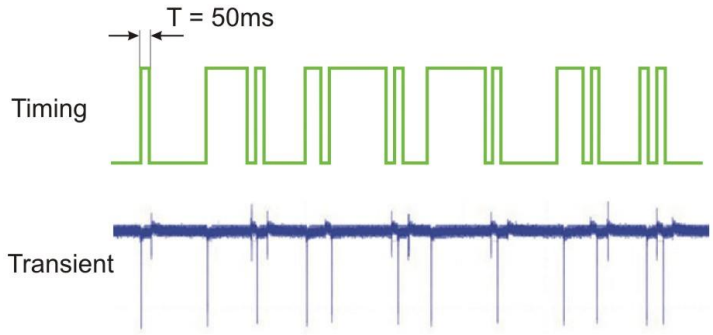


Figure 3.2 : Mode 2

Mode 3

Represents a condition where test pulses are applied using pseudo- random bursts. The timing sequence is identical as used for Mode 2.

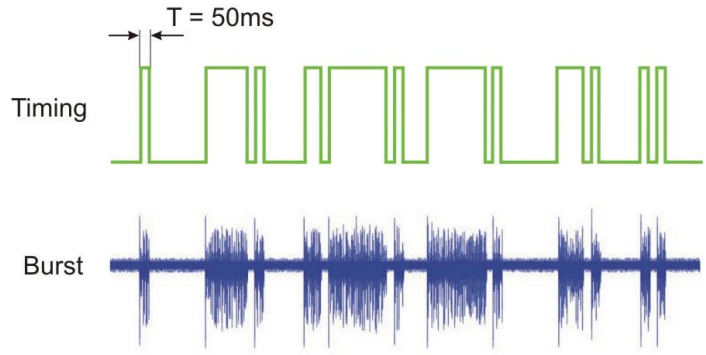


Figure 3.3 : Mode 3

3.4. START / STOP

With the START / STOP button the user starts and stops the test sequence. The release of the Start button will automatically release the TEST ON function and starts the test directly.
During running a test the following LED indicates:

LED **Sequence** : Test is running and stops after the test duration
LED **Endless**: Test is endless running. Stop with Stop button

Power on DUT
Depends on the status of the power before the test start, the voltage will be switched off after the test. Figure 3.4 illustrate the procedure of the power on handling after the test.

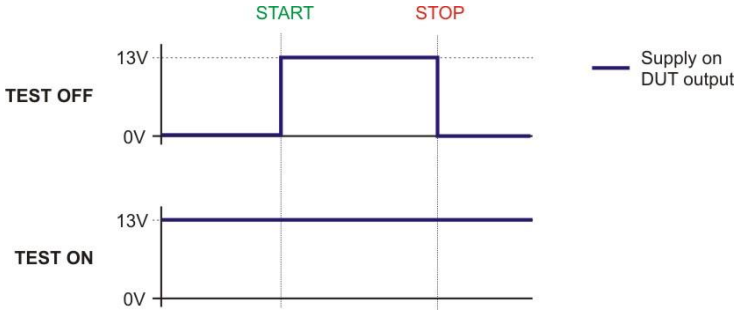


Figure 3.4: DUT power after stop

3.4.1. Sequence

The Sequence is the normal procedure for testing any DUT according the standard.

START: Press START/STOP button for begin a test sequence
STOP: Press START/STOP button for terminate at anytime a test sequence.

After pressing the START button, the test sequence will start. The LED Sequence is illuminated and indicates the running test. At the test end the generator returns automatically into STOP mode.

The SEQUENCE duration is defined by the Ford standard for each PULSE and MODE.

PULSE	MODE	DURATION	DURATION RI 130 with test fixture
A1	M1 M2	120s 20s	
A2-1	M1	120s	
A2-1 & C-1	M2, M3	20s	
A2-2 & C-2	M2, M3	20s	
A2-1	M2, M3		60s
A2-2	M2, M3		60s
F	-	60s	

3.4.2. Endless

The RCB200N1 offers an option for endless testing. This can be used for long duration tests during the development or internal quality tests.

START: Press START/STOP button **during about 2s** till the LED Endless illuminates.
STOP: Press START/STOP button for terminate at anytime an endless test sequence.

Application with **EXTERNAL** trigger signal will set the RCB200N1 automatically in "**ENDLESS**" mode

3.4.3. Stop

For stop a test the user has the following options:

START / STOP button: Stops the test and the supply voltage keeps at the DUT output terminal.
In case when the TEST ON was not enabled at the test start, the DUT supply voltage will automatically switch off.

TEST ON button: Stops the test and switches off the DUT supply voltage.
TEST OFF will stop anytime a running test and interrupt also the DUT supply voltage.

3.5. Trigger Internal - External

The RCB 200N1 offers an internal Trigger generator for the pulse timing. The user is free to connect his own trigger generator for drive the Relays. The trigger input corresponds to the input E as per Ford EMC-CS 2009 Figure F-1.

Figure 3.5 shows the two methods and connection for generate the trigger signal for RCB200N1 trigger.

A Internal Trigger: Using the binternal trigger generator with a bridge from **Trigger OUT** to **Trigger IN** BNC plug.

B External Trigger: Using an external and user programmed trigger generator device, connected direct to the **Trigger IN** BNC plug.

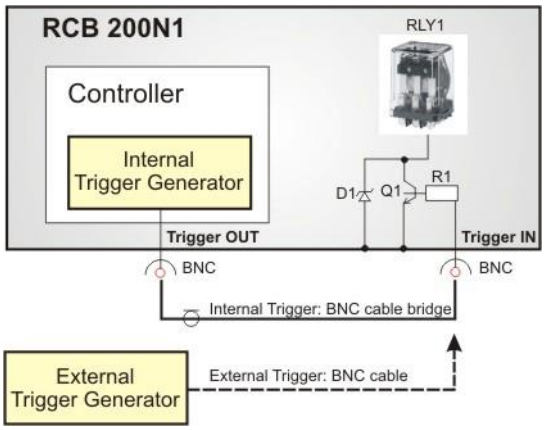


Figure 3.5 : Block diagram of RCB 200N1 trigger

Internal Trigger

Figure 3.6: Internal trigger

Function: Using the internal trigger, the controller sense automatically the bridge connection from Trigger OUT to Trigger IN. The internal processor will generate the trigger signal for relays release.

Note: Internal/External trigger detection happens with a periodic pulse train of three short pulses (<1µs) in the trigger out signal during stop status. When these “Phantom pulses” are received at the trigger in side, the controller detect internal Trigger. Otherwise the Ext Trigger LED appears.

External Trigger

Figure 3.7: External trigger

Function: An external arbitrary generator can be used for generate the trigger signal for relays release. The input is enabled after pressing the START/STOP button. The relays can be controlled after TEST ON or START button.

● EXT TRIGGER The LED **Ext. Trigger Mode** indicates the disconnected internal trigger bridge.

Remark: Lifetime is only incremented if RCB 200N1 is switched to Start in ENDLESS Mode.

3.6. Relays Lifetime surveillance RELAY EOL

The contacts of the Potter & Brumfield Relay (Figure 3.8) are worn heavily during the burst operation. The operating time of the relay contacts is approx. 100h.
A built in operation-hour counter is monitoring the lifetime of the relay and indicates the status with the LED Relay EOL “End Of Lifetime”.

Figure 3.8

Lifetime
90 h: Relay EOL LED starts to flash.
100h: Relay EOL LED lights constant. End of the operation period, the device is switched off.

External Trigger: Relays lifetime is only incremented if RCB 200N1 is switched to Start in ENDLESS Mode.

3.6.1. Timer Reset of the End of Lifetime

The resetting of the operation-hour counter is done by pressing the

MODE and **TEST ON** button simultaneously with the connection of the supply voltage to the generator (initialization).

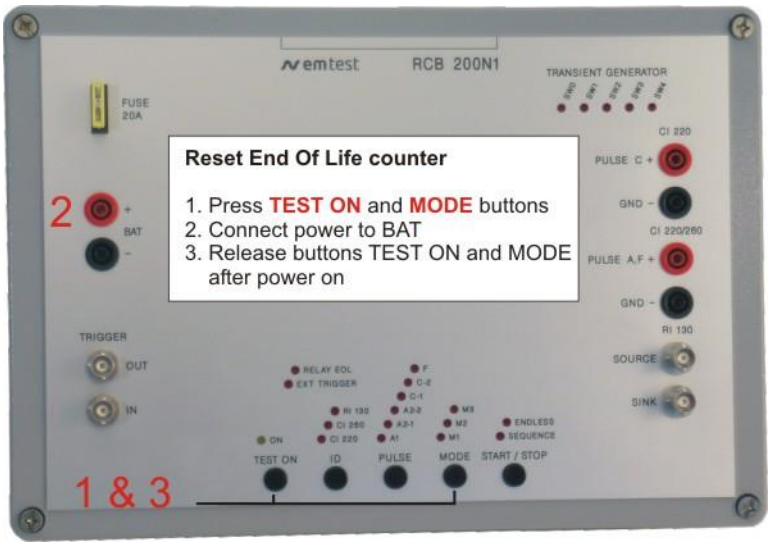
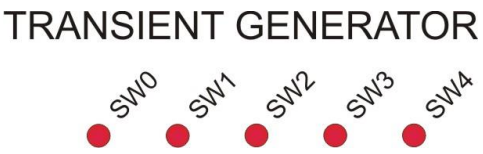


Figure 3.9 : Text inside the RCB200N1 for reset the Timer EOL

4. Generator switch configuration

On the front panel the status of the switches SW0 to SW4 is indicated in the LED line Transient generator



On the front panel the status of the switches SW1 to SW4 is indicated in the LED line Transient generator

PULSE	MODE	SW1	SW2	SW3	SW4
A1	M1 M2	**X**	**X**	**X**	**X**
A2-1	M1	**X**			
A2-1, C-1	M2	**X**			
A2-2, C-2	M2	**X**		**X**	
A2-1, C-1	M3				
A2-2, C-1	M3			**X**	

X = closed = LED for switch is illuminated

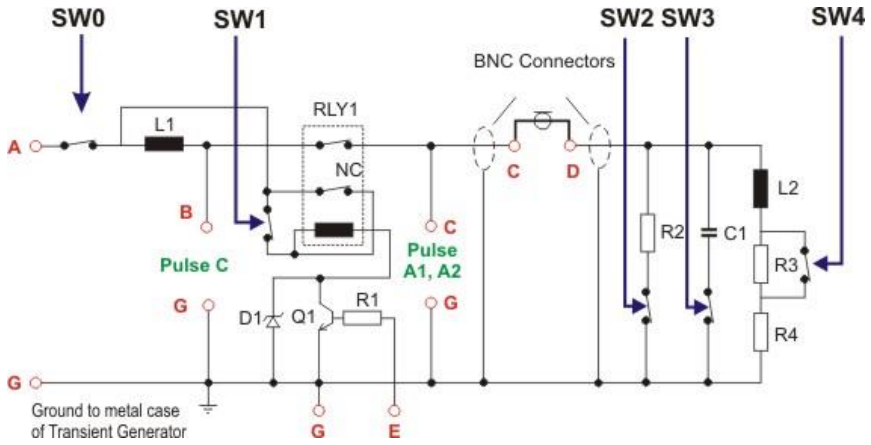


Figure 4.1:Location of switches SW0…SW4

Attention

RI 130 : Connect the Text Fixture to SINK and SOURCE

CI 220, CI 260 : Plug the BNC -Bridge

5. Technical data

5.1. Specification

Input voltage BAT	U = 13.0V +0.5V – 1.0V (Ford spec)
Current	20A max ± 10 %
Fuse	Blad fuse link FK 20A
Fuse voltage drop	105mV typical 125mV Max.
Power supply control	From BAT input (reverse polarity and overvoltage protected)
Design	According Ford spec ES-XW7T-1A278-AC Annex G
Operating range	11V – 15V
Inverse voltage protection	RCB200N1 will not operate at inverse voltage
Overvoltage protection	Switch off at approx 19V supply
Trigger Input	5V…12V , positive logic
Trigger frequency	Max. switching speed of P&B relays (1 cycle approx. 25ms)

5.2. General

Dimension	330mm x 230mm x 112 mm (L x W x H)
Weight	6.20
Temperature	23°C ± 5.0 °C
Humidity	20 to 80% relative humidity (RH) non condensing)

5.3. P & B Relay Specification

Figure 5.1

Manufacturer :	**Potter and Brumfield (P&B)**
Model :	**KUP 14A15-12**
Lifetime:	max. 100 hours

Contact Arrangement:	3 Form C, 3PDT, 3 C/O
Contact Current Rating (Amps.):	10
Coil Magnetic System:	Monostable
Coil Selection Criteria:	Nominal Voltage
Actuating System:	AC
Input Voltage (VAC):	12
Coil Suppression Diode:	Without
Coil Resistance ( ):	18
Coil Power, Nominal (VA):	2.70
Mounting Options:	Plain Case
Termination Type:	.187 x .020 Quick Connect Terminals
Enclosure:	Enclosed
Contact Material:	Silver Cadmium Oxide
Approved Standards:	UL Recognized, CSA Certified

6. Maintenance

6.1. General

The RCB 200N1 is absolutely maintenance-free with the exception of the socked relays specified by Ford

6.1.1. Ford EMC-CS-2009 requires exchanging the switching relay after a time of operation of 100 hours. After this time the test duration clock appears and the **Relays *EOL*** LED starts by blinking and the test is stopped. The relay should be exchanged by the operator.
The clock can be resetted during Test On by pressing the buttons ***Test On*** and ***Mode*** simultaneously.

6.2. Calibration and Verification

6.2.1. Factory calibration

Every EM TEST generator is entirely checked and calibrated as per international standard regulations before delivery. A calibration certificate is issued and delivered along with a list of the equipment used for the calibration proving the traceability of the measuring equipment. All auxiliary equipment and accessories are checked to our internal manufacturer guidelines.
The calibration certificate and the certificate of compliance (if available) show the date of calibration.
The EM Test equipment are calibrated in the factory and marked with a calibration mark. The used measuring instruments are traceable to the Swiss Federal Office of Metrology.
The calibration date is marked. The validity of the calibration is to the responsibility of the user's quality system. Neither the certificate of calibration nor the corresponding label mark any due date for re-calibration.

Example: Calibration mark

6.2.2. Guideline to determine the calibration period of EM Test instrumentation

Our International Service Departments and our QA Manager are frequently asked about the calibration interval of EM TEST equipment.
EM TEST doesn't know each customer's Quality Assurance Policy nor do we know how often the equipment is used and what kind of tests is performed during the life cycle of test equipment. Only the customer knows all the details and therefore the customer needs to specify the calibration interval for his test equipment.
In reply to all these questions we like to approach this issue as follows:
EM TEST make use of a solid state semiconductor switch technique to generate high voltage transients. A precious advantage of this technique is the absolute lack of periodical maintenance effort. In consequence thereof a useful calibration period has to be defined based on two criteria:
- The first one is the customer's Quality Assurance Policy. Any existent internal regulation has to be applied at highest priority. In the absence of such internal regulation the utilization rate of the test equipment has to be taken into consideration.

- Based on the experience and observation collected over the years **EM TEST recommends a calibration interval of 1 year** for frequently used equipment. A 2-years calibration interval is considered sufficient for rarely used test generators in order to assure proper performance and compliance to the standard specifications.

6.2.2.1. Calibration of Accessories made by passive components only

Passive components do not change their technical specification during storage. Consequently the measured values and the plots stay valid throughout the storage time. The date of shipment shall be considered as the date of calibration.

6.2.2.2. Periodically In-house verification

Please refer to the corresponding standard before carrying out a calibration or verification. The standard describes the procedure, the tolerances and the necessary auxiliary means. Suitable calibration adapters are needed. To compare the verification results, EM Test suggests referring to the wave shape and values of the original calibration certificate.
All calibrations and verifications are always done without mains supply voltage connected to the coupling network input.

7. Delivery Groups

7.1. Basic equipment

- Pulse generator type RCB200N1
- 1 Blad fuse link FK 20A
- Manual on USB memory card
- 2 x BNC Female – Female Bridge cable

Identical accessory parts are delivered only once if several devices are ordered. The delivered packing list is in each case valid for the delivery.

7.2. Options

- Spare relays :Set of 10

  Manufacturer: Potter and Brumfield (P&B)
  Model: KUP 14A15-12

8. Application

This application describes the setup as per Ford EMC-CS-2009 using the RCB 200N1 running on internal trigger. For detailed information please refer to the Ford EMC-CS-2009 standard. There you can find the instruction for the test requirements, test verification, test setup and test procedures.

8.1. RI 130

These requirements are related to component immunity from wire-to wire coupling of unintended transient disturbances. The originate of these disturbances are from switching of inductive loads including solenoids and motors.

Mode	Pulse	Functional Performance Status		
	60s duration	Class A	Class B	Class C
2	A2-1	I	I	I
	A2-2	I	I	I
3	A2-1	I	I	I
	A2-2	I	I	I

Default test setup

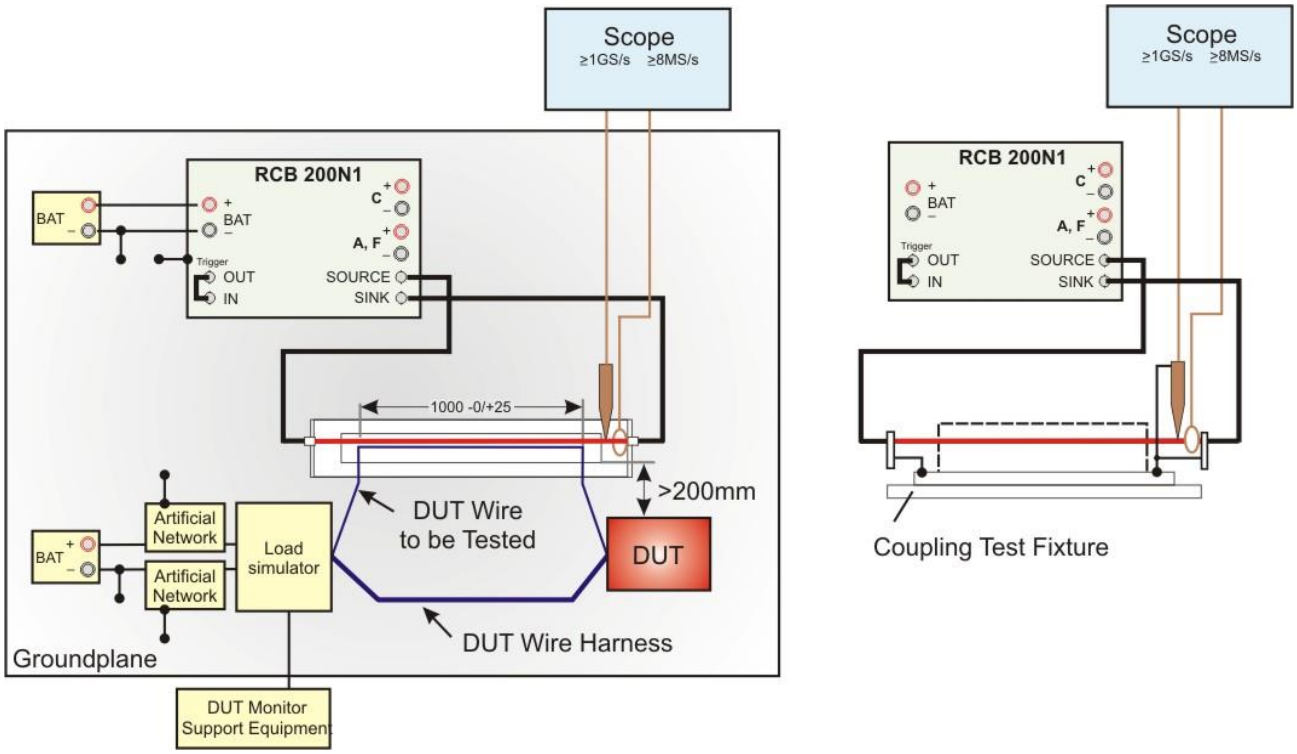


Figure 8.1 : Setup for RI 130

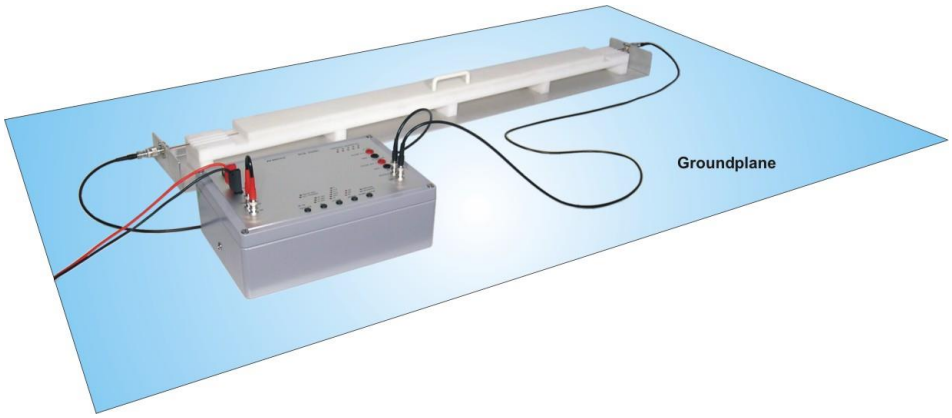


Figure 8.2 : Setup for RI 130 RCB200N1 and test fixture

8.2. CI 220

These requirements are related to immunity from conducted transients on power and control circuits connected directly to the vehicle's battery or indirectly by a switch load.

Pulses performed with using the RCB 200N1

Transient Pulse	Application	Transient Characteristics	Duration	Functional Performance Status		
				Class A	Class B	Class C
Pulse A1	Switched power supply circuits with maximum current <5A	Mode1	120s	II	II	II
	Input circuits	Mode2	20s	II	II	II
Pulse A2-1	Switched power supply circuits with maximum current <5A	Mode1	120s	II	II	II
Pulse A2-2	Input circuits	Mode 2 Mode 3	20s	II	II	II
Pulse C-1 Pulse C-2	All power supply circuits & input circuits	Mode 2 Mode 3	20s	I	I	I

Other generators must be used for perform the CI220 pulse tests: E, F1, F2, G1 and G2.

CI 220 Test setup for Devices with a single Power Supply Circuit

Figure 8.3 shows the setup for testing single DUT with power supply circuit with remote ground connection.

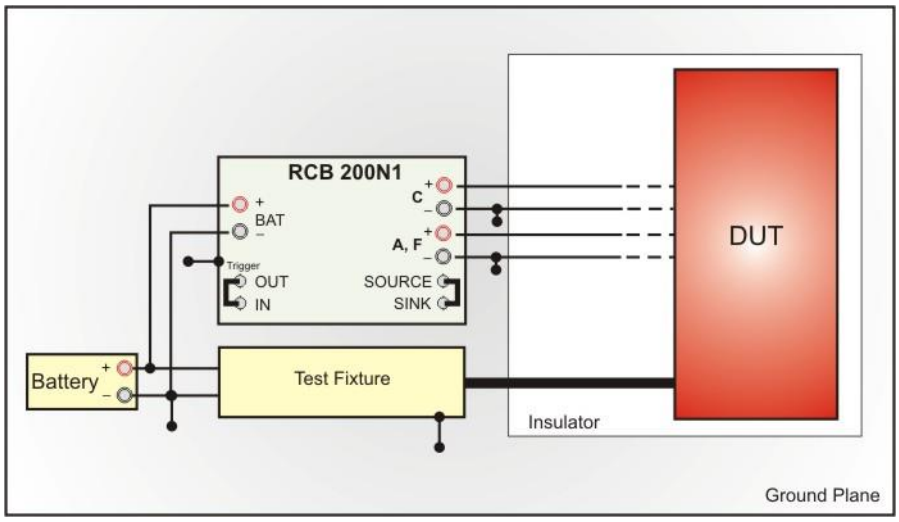


Figure 8.3 : Setup for CI 220 with single Power supply circuit

CI 220 Test setup for Devices with Two power Supply Connections

Figure 8.4 shows the test setup for devices with two supply circuits. The untested power supply circuit (U1) is connected directly to the battery. If the device has an additional power supply circuits operating at the same voltage, those circuits should also be connected directly to the battery.

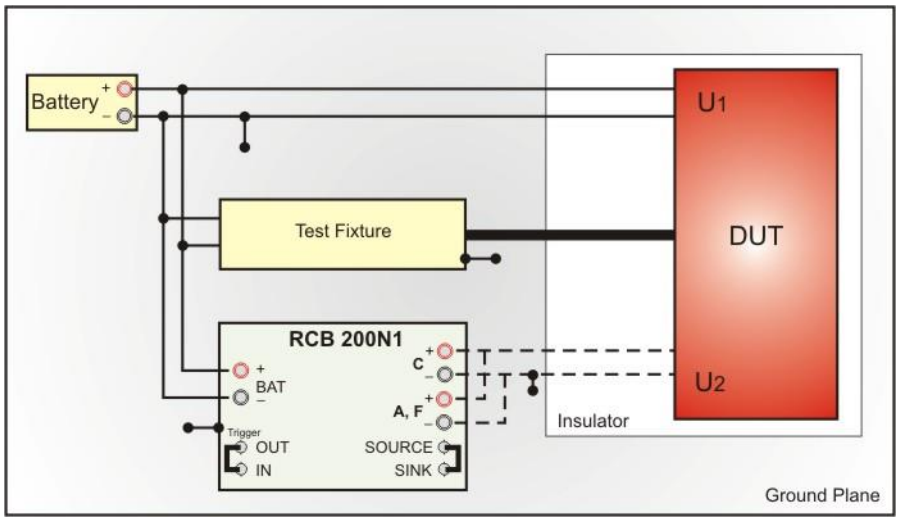


Figure 8.4 : Setup for CI 220

CI 220 Test setup for Devices with Input Circuits

Figure 8.5 shows the setup for testing input circuits. The circuits may be directly or indirectly connected to switched battery circuits.

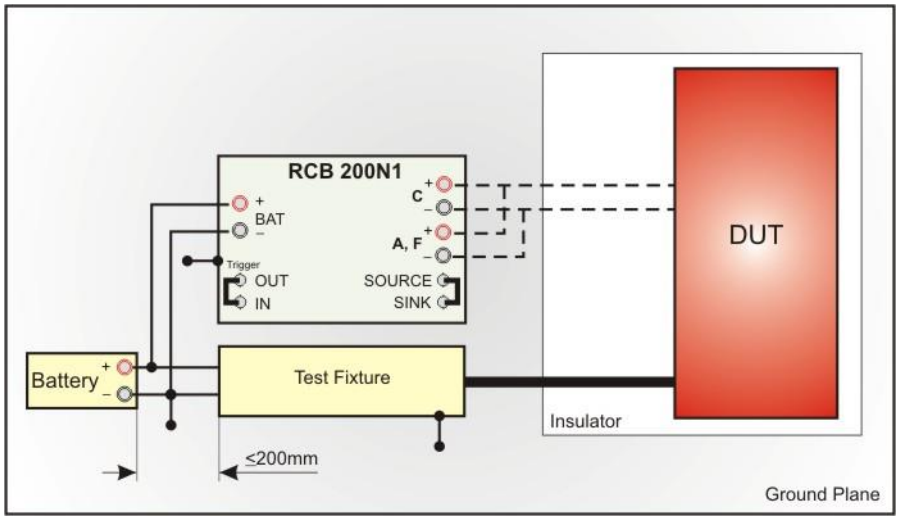


Figure 8.5: Setup for CI 220

CI 220 Test setup Detail (Input Circuits with Remote External Pull-Up Resistor)

Figure 8.6 illustrate the special case where the control circuit is connected to the battery indirectly using a pull- up resistor located in another module.

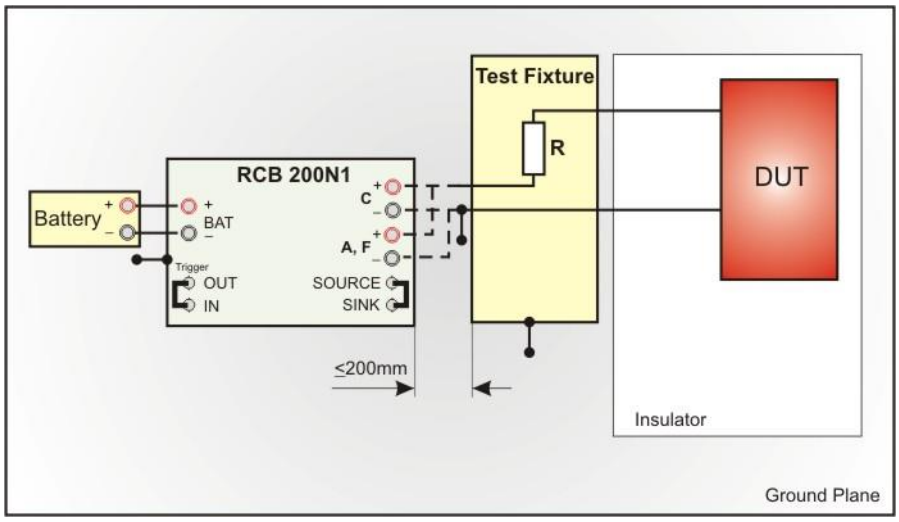


Figure 8.6 : Setup for CI 220

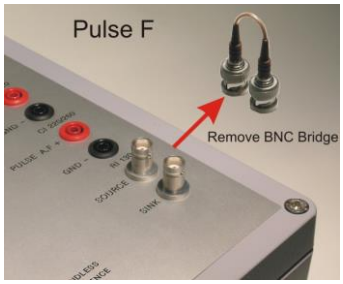
8.3. CI 260

This test simulates momentary voltage drops, which may occur over the life of the vehicle. The purpose of this test is the verification of controlled recovery of hardware and software from power interruptions.

Remove the BNC Bridge

SOURCE – SINK

before starting the test with Pulse CI260F



Waveform	Application	Level	Duration	Functional Performance Status		
				Class A	Class B	Class C
F	All power supply <5A and input circuits	Random Bounce	60s	II	II	II

Other generators must be used for perform the CI260 pulse tests: A, B, C, D, and E.

Waveform F Random Bounce

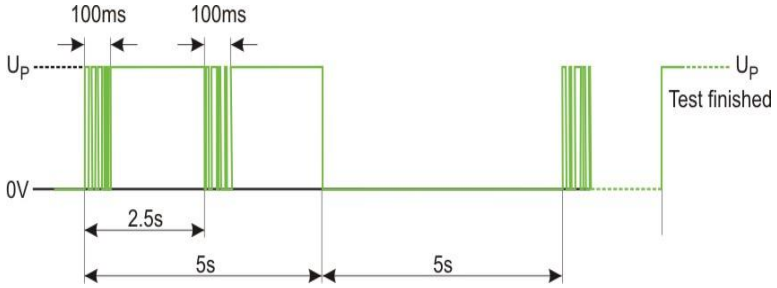


Figure 8.7 : Waveform F

The test starts with OFF position of the power supply. The relay will bounce during 100ms before switch on the supply. Figure 8.7 illustrate the test procedure for waveform F. At the test end the supply voltage is ON.

CI 260 Test setup for Waveform F

Figure 8.8 illustrate the setup for testing random bounce.
For this test no groundplane is mandatory.
For waveform F, measure and verify that the waveform voltage is similar to that in figure 8.7. The measurement shall be made with DUT disconnected from the RCB 200N1.

Note : Remove the bridge Source- Sink before the test. If the bridge is not removed the DUT may be overtested by transiens.

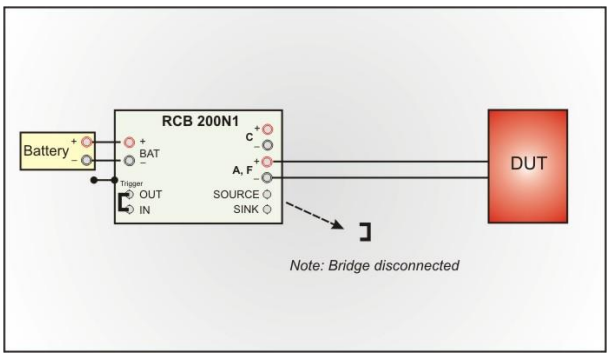


Figure 8.8 : Setup for CI 260 Waveform F

9. Waveform Verification

The Waveform verification is made at the RCB200N1 running the internal trigger.

- Plug BNC bridge Trigger OUT to Trigger IN

9.1. CI 220 Pulse verification

According to the standard the pulses are connected at different places in the test generator. The RCB 200N will connect the output C and output A1 / A2 at the shape output plugs by internal relay switching.

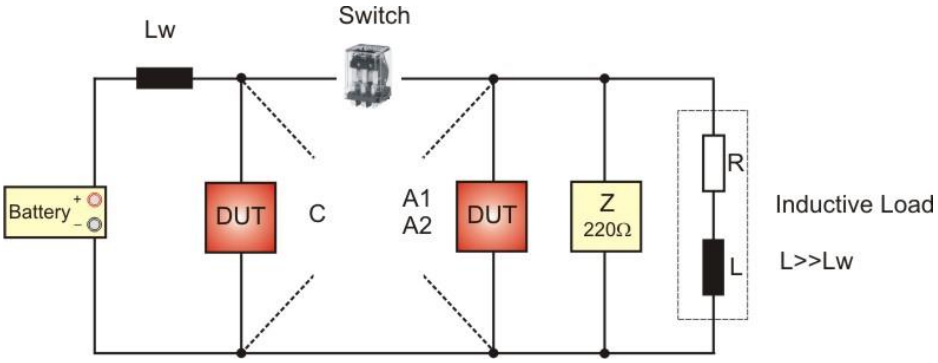
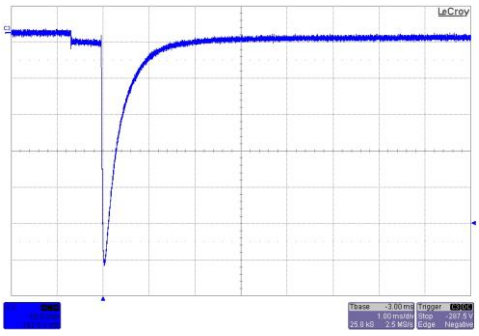


Figure 9.1 simplified Automotive Circuit for transient Immunity

Pulse A1 Composite Waveform represents the voltage transient produced by an inductive load with current between 1A to 5A in the same circuit with the DUT. The impedance Z simulates a minimally load circuit with 220Ω.

Peak Voltage: -250V to -300V

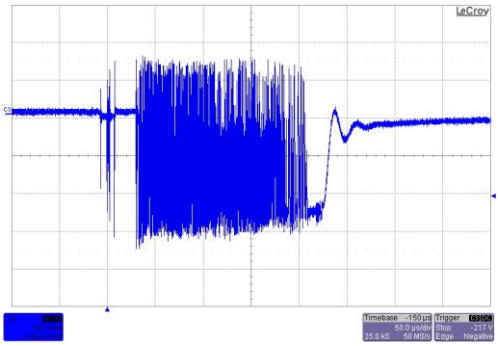


50V/div
500us/div

Figure 9.2 Pulse A1

Pulse A2 represents the voltage transient produced by an inductive load with current smaller 1A in the same circuit with the DUT. The characteristic of pulse A2 can vary significantly depend the load in the same circuit.

Pulse A2-1 occurs when the circuit consists only of the DUT and the switched load.
The characteristic is a high frequency repetitive pulse with positive peaks.

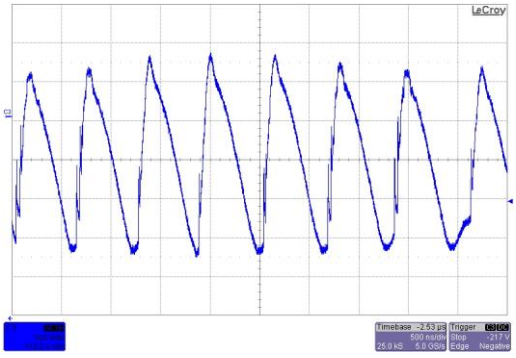


100V/div
50us/div

Figure 9.3 Pulse A2-1

Characteristic:

Positive peak Voltage: +100V to +300V
Negative peak Voltage: - 280V to - 500V
Duration : 100ns to 1us



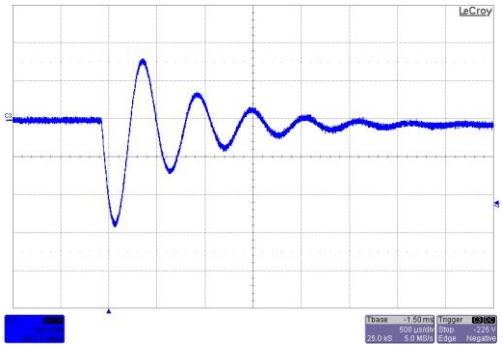
100V/div
1us/div

Figure 9.4 Pulse A2-1 detail

Pulse A2-2 occurs, when the external circuit has predominantly a capacitive characteristic. When the switch contacts open, a damped sinusoidal transient is produced.

Ringing frequency

Contact Break (Fig 9.5) : ~ 2kHz
Contact Bounce (Fig 9.6) : ~ 180kHz

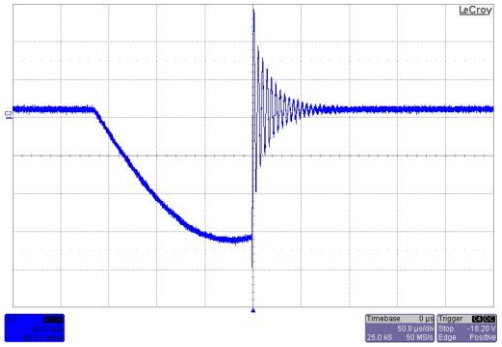


100V/div
500us/div

Figure 9.5 Pulse A2-2 Contact break

Remark:
For measuring the pulse A2-2 with the scope the user needs several measurements. To get the desired picture depends on the characteristic of the relay contacts at the time of measurement.

Tip for record:
Use the current level as trigger

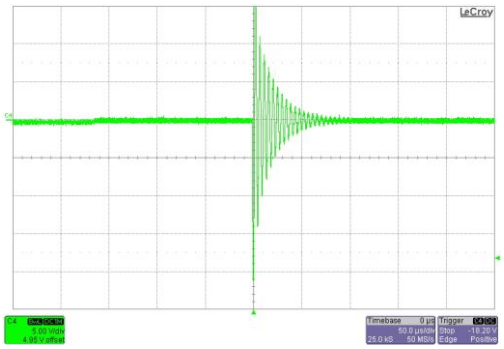


50V/div
20us/div

Figure 9.6 Pulse A2-2 Contact bounce

Pulse A2-2 Contact Bounce (Current)

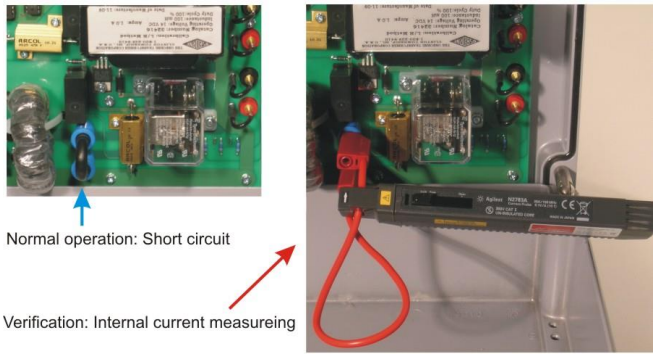
Current Measuring:
- Between BNC plugs SOURCE-SINK (RI130)

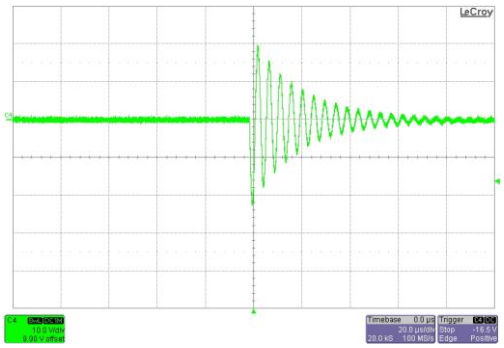


5A/div
50us/div

Figure 9.7: Pulse A2-2 current

- Current Measuring: Internal at 5uH Coil - Relay



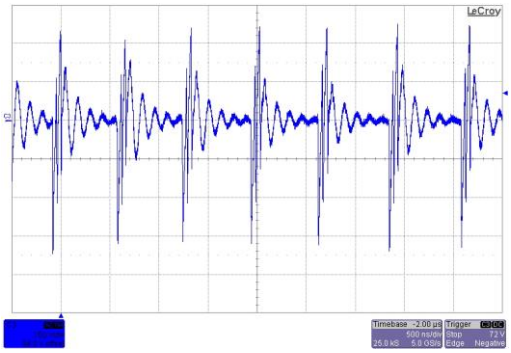


5A/div
20us/div

Figure 9.8: Pulse A2-2 current internal

Pulse C represents the transient pulse produced by a switch contact arching and contact bounce during switching of an inductive load.
The characteristics are a function of the series wiring inductance and the current during arcing switch or bounce.

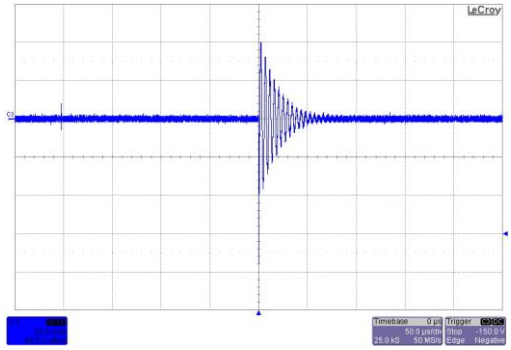
Pulse C-1 characteristic of higher damped sinusoidal:
Frequency : ~10MHz
Voltage : ~ ± 150V
Duration : 100ns to 1µs



100V/div
1us/div

Figure 9.9 Pulse C-1

Pulse C-2 characteristic of lower damped sinusoidal:
Frequency : ~180kHz
Voltage : ~ ± 150V
Duration : 50µs



100V/div
20us/div

Figure 9.10 Pulse C-2

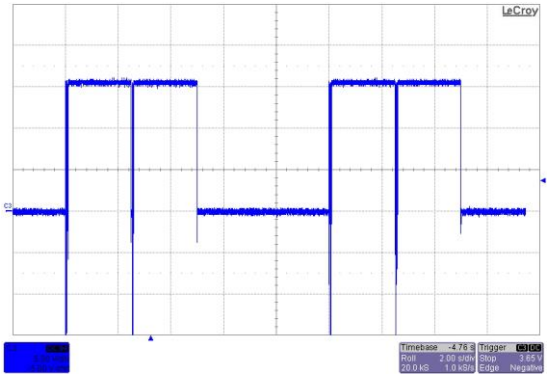
9.2. CI 260 pulse verification

The verification shall be made with the DUT disconnected from the RCB200N1.

Measure and verify that the test waveform voltages are similar to that illustrated in figure 9.11 and 9.12.

During the first 100ms the relay will switch on and off and generates unsteady pulses.

The pulse can be measured between the plugs OUT+ and OUT-



5V/div
2s/div

Figure 9.11 Pulse F measurement

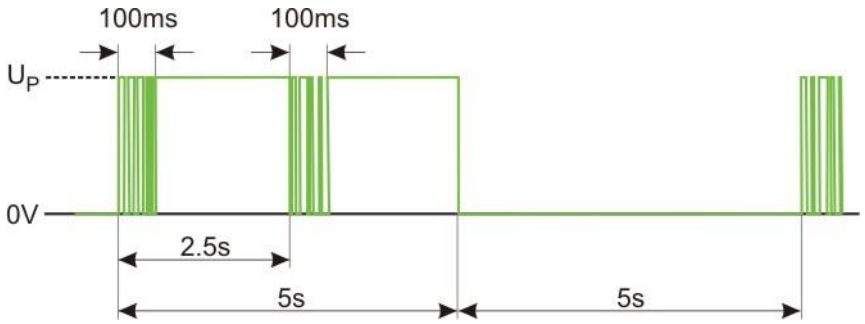
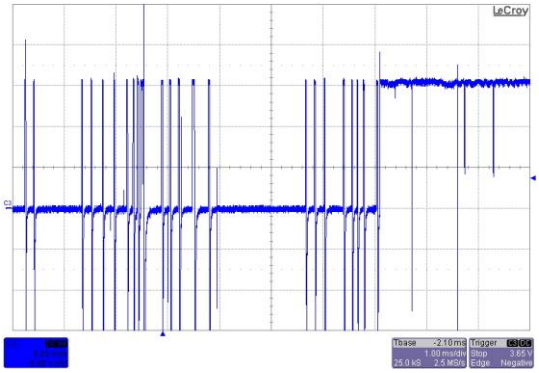


Figure 9.12 : Waveform F

Figure 9.13 shows the expanded waveform F during random bounce.



5V/div
1ms/div

Figure 9.13 Pulse F expanded

CI 220 Mode 2 Mode 3 Characteristics

Upper line :
Trigger signal

Lower line :
Output signal

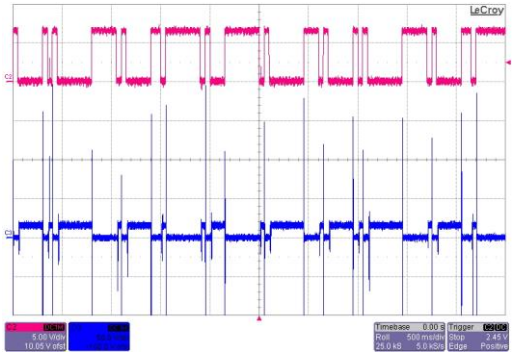


Figure 9.14: Timing Mode 2

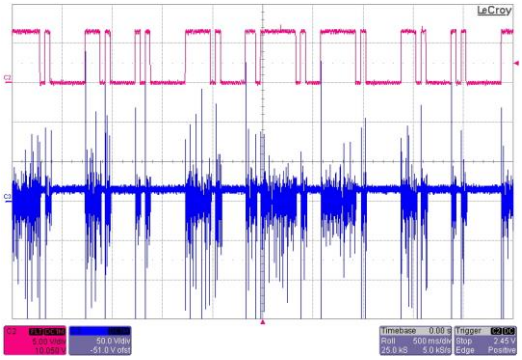


Figure 9.15: Timing Mode 3

9.3. RI 130 pulse verification Pulse A2-1 and A2-2

The pulses are the same as used in CI 220. Different is the coupling to the coupling test fixture instead to the DUT. The test fixture is connected between the BNC plugs SOURCE and SINK as ilustred in figure 9.17.

A digital scope shall be used for voltage and current verification. The oscilloscope shall have the following specs:

Sampling rate : ≥ 1GS/s
Memory depth: 8 MS/ for single channel.

Voltage probe : 1:100 high impedance (C <4pF)
Current probe : >30MHz , 30A

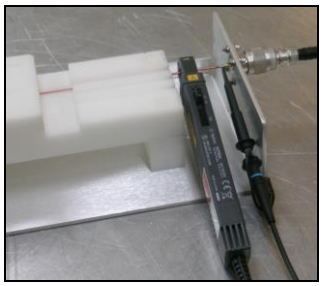


Figure 9.16: U/I probes

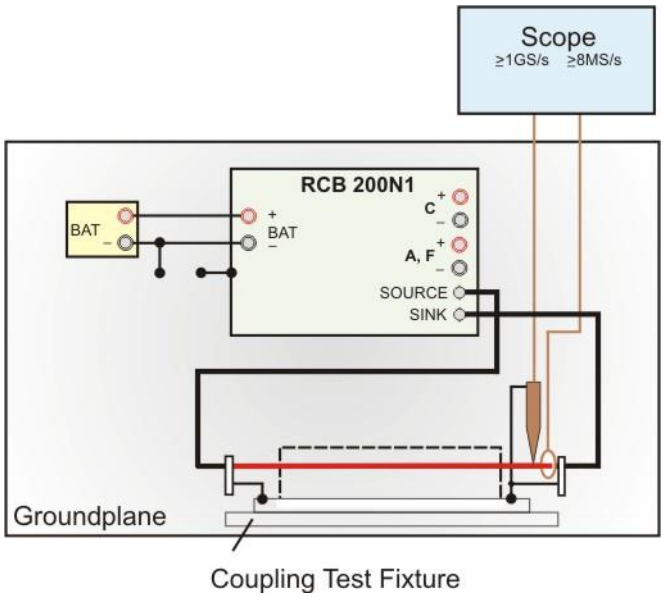


Figure 9.17: Verification Setup RI 130

Pulse A2-1

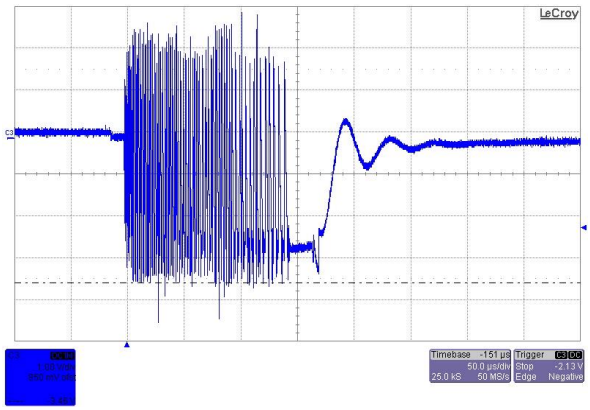


Figure 9.18 Contact Break and bounce 100V/div ; 50µs/div

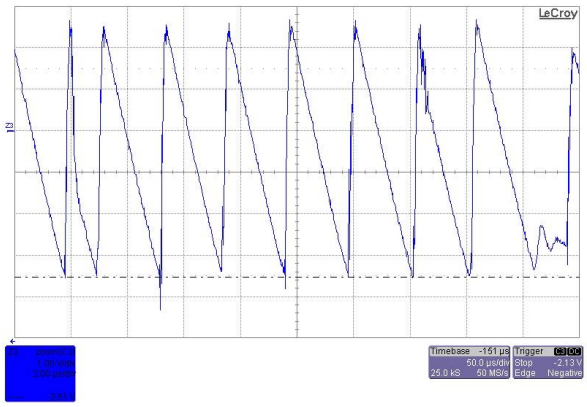


Figure 9.18 Contact Break and bounce 100V/div ; 2µs/div

Pulse A2-2

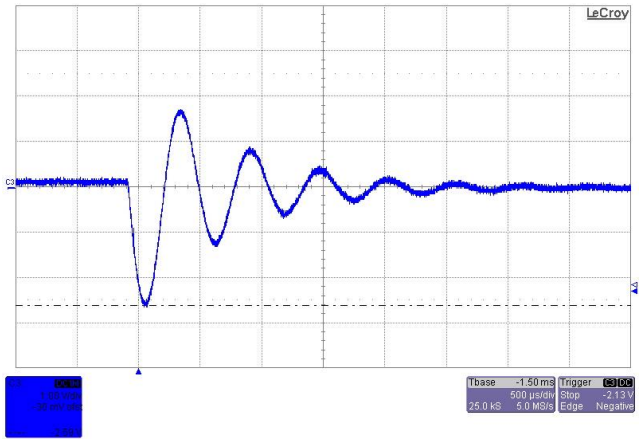


Figure 9.19 Contact Break and bounce 100V/div ; 0.5ms/div

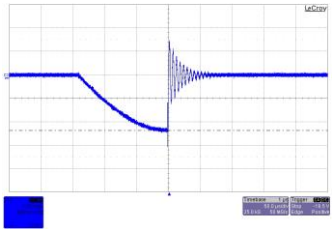


Figure 9.20:

Contact bounce voltage
100V/div ; 50µs/div

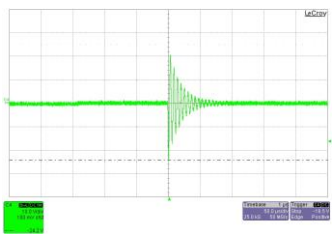


Figure 9.21:

Contact bounce current
10A/div ; 50µs/div

10. Appendix

10.1. Declaration of CE-Conformity

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Relay Chatter Box
Model Number(s)	RCB 200N1

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

Ford EMC-CS-2009 Ford FMC1278	The RCB20N10 is build according the normative annex G in the Ford FMC1278 and Ford EMC-CS-2009 specs. The built in circuit and the mounted relays will produce radiated and conducted interferences which is the function of this test device. The user has to take care about radiated interference caused the sparking between the contacts during the test is running. There is not only conducted interference which may influence the DUT but also a significant amount of radiated interference which may disturb electronic devices in the close vicinity which are not part of the test setup.

The purpose of this instrument is the generation of defined interferences signals for EMI immunity testing. Depending on the arrangement of the test rig, the configuration, the cabling and the properties of the EUT itself, a significant amount of electromagnetic radiation may result that could also affect other equipment and systems. The user himself or herself is ultimately responsible for the correct and controlled operation of the rig. In case of doubt, the tests should be carried out in a Faraday cage.

	European representative	Manufacturer
	AMETEK CTS Germany GmbH Lünenerstr. 211 D 59174 Kamen Tel: +49 (0) 2307 / 26070-0 Fax: +49 (0)2307 / 17050	EM TEST (Switzerland) GmbH Sternenhofstr. 15 CH 4153 Reinach Tel: +41 61-7179191 Fax: +41 61-7179199
By	A. Gerstner General manager	A. Burger Business Manager Conducted EMC
Place	Kamen, Germany	Reinach BL, Switzerland
Date	20. December 2016	25. February 2016