Dyna-Sense®

Quick Break Detector
Universal Shot Timer
Model QB-2 Plus

US PATENT – US 7,595,637 B2

Instruction Book

SCIENTIFIC INSTRUMENTS, INC.

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The Dyna-Sense® QB-1/QB-2 Quick break detector is the new industry standard
Unique exclusive features of this unit are:

- **LCD digital readout** Displays peak quick break voltage, in a quantitative way, facilitating detection of possible degradation of quick break feature in mag unit due to equipment aging or malfunction. Allows recording of quick break voltage for tracking the trend of the quick break status.Measures quick break voltage up to 29 volts.

- **Precision reference air coil transducer** Gives reliable, repeatable indications of quick break intensity. It is manufactured under controlled conditions, checking for accuracy of inductance, turns, and DC resistance.

- **Microprocessor controlled** Accurate signal capture and peak detection.

- **Low Battery Detection** Ensures unit will not operate if battery does not have sufficient charge.

- **Shot time Detection** Available on QB-2 model only. Reads shot time up to 9.99 seconds with .01 sec resolution on the display.

Why check for quick break?

The importance of quick break while doing coil mag shots was noted in the 1950's during research by MAGNAFLUX CORPORATION.

It was shown that a rapid decay of the current flowing in the coil at the end of the mag shot also produces a rapid collapse in the magnetic field in the coil. This rapid field collapse results in a higher magnetic field being contained inside the part which is being inspected. A higher field contained in the part will increase the sensitivity of magnetic particle inspection, and may very well give defect indications which would not have been detected if there was not a good or sufficient quick break in the coil during the mag shot.

It should be noted that this quick break phenomena noted above is not only required by Mil SPEC 6867C procedures, but it should be tested for all users of magnetic particle inspection equipment, when using 3 phase full wave dc as the source of the mag current, to ensure you are inspecting with maximum sensitivity.

Why use this type of tester over others?

Until recently, it appears that the only method of quick break detection widely used in the industry for the past 30 years has been a tester which utilizes a neon bulb or more recently , an LED. Both of these types of testers only provide a qualitative indication of quick break (how bright did the bulb flash?), or a go/no go indication (did the bulb flash or not?).

Furthermore, it has been noted that the neon bulb type of tester has a change in sensitivity when exposed to light or used in the dark, which appears to be due to some type of change in the neon bulb firing voltage when exposed to light. Also, the firing voltage of a neon bulb is not a tightly controlled parameter.

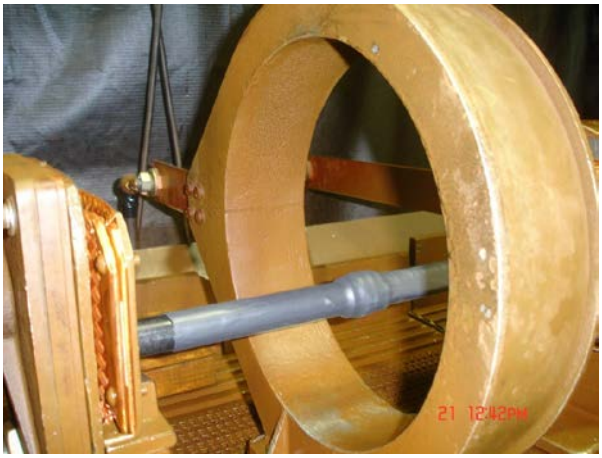
The QB-1/QB-2 has none of these drawbacks, and provides a high accuracy quantitative indication.

CORRECT ORIENTATION OF TRANSDUCER PROBE

CORRECT – Transducer is well centered coaxially and coplanarly in the mag unit coil.

Mag coil too far to the right of the transducer coil.

Mag unit coil is too far to the left of transducer coil.



Transducer is clamped too low in the headstock/tailstock, raise it up until it is in the center of mag unit coil.

CONTROLS

Front Panel Controls and Indicators

PWR "ON/OFF" Switch Push once to turn unit on, push again to turn unit off.

"RESET" Pushbutton Push to reset display to be ready for another quick break reading.

TRANSDUCER INPUT JACK Plug RCA phone plug from transducer cable in.

LCD DISPLAY allows instant viewing of quick break voltage. Reading will be held until "reset" pushbutton is pressed.

Rear Panel (underside of unit)

Quick Break Reference Table Allows quick verification if mag unit is meeting the Mil SPEC 6867C for a given coil size.

MIL6867C Table V- Voltage induced by Magnetizing Coils

Size of Coil	Voltage Peak Reading
12 inches	8 volts
16 inches	6 volts
20 inches	4 volts
25 inches	3 volts

Must Measure at 15000 ampere-turns in coil

BASIC OPERATION

Quick Break Voltage Measurement

The Quick Break detector QB-2 Plus quick break feature is primarily intended to be used with 3 phase full wave dc output horizontal wet inspection units. It is designed to help the operator determine if the mag unit under test meets the Mil SPEC 6867C for quick break.

On the front panel of the Quick Break unit check and/or actuate the following:

- "Clamp air coil transducer pick up probe(17'' long rod) between headstock and tail stock of mag unit, centering the air coil transducer in the mag unit coil. Move the mag unit coil horizontally on the unit rails until the mag unit coil is in the center of the 17" transducer rod. See picture on page 4. IT IS VERY IMPORTANT TO CENTER THE TRANSDUCER PICK UP COIL IN THE X,Y and Z AXIS OF THE MAG UNIT COIL,IN ORDER TO GET AN ACCURATE READING.You can mark the tailstock and headstock where probe is located(scribe the circumference of the rod where it touches the headstock and tailstock pads) in order to have good repeatability the next time you do the quick break test. Please note the the centering of the aircoil pick up probe is not critical if only measuring shot time duration

- Plug RCA phone plug from transducer coil into the jack located on the lower left corner of the front panel of the digial display measuring unit. Locate the measuring unit away form the Mag Unit coil by at least 2 feet,preferably by holding the display unit in front of Mag unit below push bar.

- Push "ON/OFF" pushbutton located on lower right corner of front panel. LCD display will display a series of messages as the unit powers up:

  1st) S/I QB2+ (indicates which model you have,in this case QB2+)

  2nd) REV. 1.3 (indicates software version, you may have a later version indicated by a higher number than 1.3)

  3rd) ThrehId (indicates trigger threshold voltage value selected> this is not a user settable option). Default value is .3 volts.

  4th) Val=0.3 (threshold is .3 volts)

  5th) "**Push reset to select mode" (SHOTTIME or QUIK_BRK)..repeatedly pushing the "RESET" button will toggle the mode selection between shottime and quickbreak functions**

  6th) depending which mode you selected, the display will read "ST_READY" or "ST_READY"

  The QB-2Plus is now ready to test for quick break.

1) Turn on mag unit under test, and select “coil” output. Set mag unit shot timer to 0.5 seconds, DO NOT SET LONGER THAN 9.9 SEC. OR SHORTER THAN .2 SECONDS FOR PROPER TEST RESULTS.

2) The output current of the mag unit must be adjusted to provide 15,000 ampere-turn field strength…For a 5 turn mag unit coil, this would correspond to a mag shot current of 3000 amps. If you are unsure of how many turns your mag unit coil is, consult the manufacturer. It is very important to establish a 15000 ampere-turn field strength. Most coils are 5 turns, but make sure as some coils can be more or less than 5 turns. IF IN DOUBT CONSULT THE MANUFACTURER OF THE COIL. DO NOT PROCEED WITH THE TEST IF YOU ARE NOT SURE OF THE NUMBER OF TURNS ON THE COIL.

3) If you did a mag shot in the preceding step to set up the output current, then the QB-1/QB-2 has already captured a quick break reading. Note that once the QB-1/QB-2 has been triggered by a coil mag shot, the display will read “ACQ/TRG” while it is computing the quick break voltage. There is approx. a 2 sec. delay after triggering until the display indicates the quick break voltage,as the microcomputer is analyzing the waveform. Push the reset button on front of QB-2 panel, and you are ready for another reading.

4) Do another mag shot, and check that the output current reaches the correct value…Now read the quick break voltage indicated on the LCD display on front of the QB-2. Note this voltage. Also note that the LCD display has a resolution of .1 volts, so 4 volts will be displayed as 4.0. If the actual quick break voltage exceeds 29.7 volts, the display will read “>30V_OVR”

5) Repeat steps 2 and 3 until you have done a mag shot and checked the quick break voltage 5 times, noting each reading. Don’t forget to push the “reset” button on the QB-2 after every reading is noted, in order to be ready to take another reading.

6) Now that you have 5 quick break readings, take the lowest value, and look at the table printed on the underside of the QB-2. Look for your coil size, and compare the minimum quick break voltage in the table to the lowest reading you took previously. If your last reading is above the minimum value indicated in the table for your coil size, then you pass the MIL SPEC 6867C quick break test. MAKE SURE YOU MEASURE YOUR COIL SIZE!! IT IS THE INSIDE DIAMETER OF THE COIL.

7) We recommend for safety, that you take at least .5 volt of margin when using the quick break table…so, for example, if you read a quick break voltage of 4 volts using a 20” ID coil, and the table says that the minimum voltage for quick break is 4 volts, you may conclude that you pass(marginally) the quick break test, but we would suggest that you make sure to read a quick break voltage of at least 4.5 volts in this example(USING 20” COIL) from the QB-1/QB-2 to ensure well passing the test.

8) Mag units which utilize coil contactor drop out to ensure quick break usually indicate a quite high quick break voltage (15v to 25v, depending on coil size), well over the minimum values indicated in the Mil SPEC 6867C tables. This is normal for these type of units. What is important to track with these type of units is the trend of the quick break voltage over time (from month to month). It should also be noted that with this type of unit, the quick break voltage indicated may vary from shot to shot by as much as 1 to 2 volts>>>this is due to the variance of the arc drawn when the coil contactor opens at the end of the mag shot.

Shot Time Measurement

1) This function is available on the QB-2 Plus . It is designed to work with all wet horizontal wet mag units and mag power packs. It will detect the shotime on all AC, DC, half wave and full wave, single or 3 phase mag units

2) When the display reads "ST_READY", it is armed and ready to capture the mag shot duration, so go ahead and do a mag shot

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3) After noting the shot time duration reading taken, you can push the “RESET” button, to reset the QB-2 to be ready to take another sample with a new mag current shot.

4) for measuring the shot time duration on power packs, just place the black pick up probe perpendicular to one of the 4/0 output cable of the power pack, forming a cross between the 4/0 cable and the black pick up probe, with the coil in the center of the pick up probe intersecting the 4/0 cable, as shown in below picture

What things you can interpret from using the QB-1/QB-2

By measuring and keeping track of the trend of quick break voltage, you may be able to detect problems with your mag unit:

- If your unit uses contactor drop out on the coil circuit to ensure good quick break, you may see the quick break voltage decreasing over time if the coil contactor contacts, springs or other associated controls are degrading. Such a trend would indicate it's time to check the contacts and springs in the contactor, as well as any auxiliary contacts that may be used to aid in obtaining quick break. Determining whether your unit utilizes this older method of developing quick requires looking at the unit schematic, and or consulting with the manufacturer. Many older primary current control units (such as reactor control or primary scr module type) fall into this category. You may also be able to verify coil contactor drop out at the end of the mag shot, by listening for a loud clunking sound at the beginning and end of the mag shot (as the coil contactor pulls and drops out), or by observing the coil contactor visually during the coil mag shot, by removing the back panel of the unit (which should only be done by qualified electrical maintenance personnel).

- If your unit does not use contactor drop out to ensure quick break (many modern secondary control scr units work this way), the quick break voltage is more or less guaranteed by design, but it still needs to be checked regularly to ensure conformance to the MIL SPEC 6867C. Even with these modern secondary control scr type mag units, contactor drop out is sometimes used for very large coils (over 25" inside diameter), to ensure good quick break, but this method is not preferred as it has a tendency to degrade the contacts on the coil contactor over time (even in 1 to 2 years, depending on rate of use of the mag unit).

ERROR MESSAGES AND SPECIFICATIONS

Within the controller display, the following error codes may appear. These codes, their meaning, and the actions to be taken are described below:

LOW BATT

Display indicates this message when the 9 volt battery is too low to continue. Turn off unit and replace battery using a high quality long life battery. We recommend using a lithium battery such as “Ultralife U9VL-FP”, which will give 45 hours of continuous operation. A standard alkaline battery will only give 12 hours of operation. To replace the battery, unscrew the 4 front panel screws located at the very extreme ends of the 4 corners of the front panel. Then gently pull the front panel up and away from the case bottom. Located on the back side of the pc board is the battery holder. Gently pry the battery out of the holder at the end of battery opposite its connection terminals. Re install the new battery the same way, inserting the end with the connector s on it first into the battery holder, and then gently pressing down the other end of the battery into the plastic holder. You may have to gently pry open the plastic width of the battery holder at the connection end, when using a 9V battery which is a little larger than usual. Normally, it is best to send the unit in for recertification when the lo batt message is indicated, and we will replace the battery for you at the time of calibration.

SPECIFICATIONS

Accuracy of voltage indication as measured thru direct injection of dc voltage source at transducer input jack is 1% of reading, +/- 2 counts on display least significant digit. Resolution is .1 volts.

Accuracy of shot time indication is 1% of reading, +/- 2 counts on display least significant digit. Resolution is .01 sec. Timing range is .20 to 9.99 sec.

The transducer coil on the probe is precision wound, with very accurate inductance and dc resistance…never try to use any other type of probe than the one provided by us with the QB-2 tester.

Battery life is approx 45 hours continuous operation when using a 9V lithium battery. With a alkaline battery, the life is reduced to approx. 12 hours continuous use.

CARE AND USE

As with any precision instrument, care must be taken when handling this device. Although it is robust, do not immerse or splash the transducer coil probe or the digital measuring unit with any liquids.

Do not strike the transducer coil probe or digital measuring unit against any objects, or drop them on the floor.

Do not insert the digital display measuring unit directly inside or near the end of the Mag Unit coil

CALIBRATION

Periodic calibration is advised once per year. The battery will also be replaced during this service. Please contact factory, see page 11 for phone #. Please send back both transducer probe and LCD display meter.

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