INSTRUCTION MANUAL

DC Resistance Bridge

DB502

Revision September 2009

Table of content

List of Figures

Unpacking the instrument

When unpacking the instrument, we recommend you to keep the packing material in order to pack the instrument sufficiently when shipping the instrument for calibration or maintenance. Remember you have purchased one of the most sophisticated DC Resistance Bridges available for automatic testing so in order to exploit the full potential of the equipment, make sure it is calibrated and maintained after the conditions stated by Danbridge.

Warranty

Danbridge A/S warrants that the delivered products are free from defects in material and workmanship for a period of one year from the date of delivery. Further details are available in the document “Danbridge Sale and Delivery Terms and Conditions” on our website www.danbridge.com

Introduction

Safety Precautions

This instrument is designed and manufactured in accordance with the European rules for electrical safety. Consequently the instrument confirms with the rules for electrical and magnetic interference, emission and radiation and is thereby having a CE Marking .

Please note the following elementary safety precautions should always be taken into consideration.

Do not remove the cover before the instrument has been switched off and the mains cable has been removed.

(Please note that by opening the cabinet and breaking the seal, the guarantee becomes void)

If the cover has been removed, please take all necessary precautions against anti- static discharge by grounding yourself sufficiently before touching any circuits or components.

Please note that capacitors in the power supply of the instrument may be charged even when the power has been switched off.

Finally we emphasise that this instrument is designed for high precision measurements and will only live up to our specifications when installed, calibrated and used properly and in accordance with the manufacturer’s instructions.

Switch-On

Before switching-on please note that the switch-mode power supply will automatic adjust to the mains voltage in the range from 90V to 240V AC 50 or 60 Hz.

This Instrument

Thank you for purchasing Danbridge test equipment. By showing us this confidence, we will do our utmost in order to support you and help you to get your Danbridge instrument running and working in good calibrated condition.

For questions or comments you are always welcome to contact Danbridge. We can be reached the following ways: phone: +45 4495 5522, fax: +45 4495 4504.
e-mail: service@danbridge.com or sales@danbridge.com

Web address: www.danbridge.com

The DB502 is an advanced DC Resistance Bridge, designed for high speed and high precision measurements. The instrument is equipped with numerous advanced features and is easy to use due to the logical user interface.

The DB502 is a DC Resistance Bridge with a wide measuring range from 10mΩ to 1GΩ. For further details, please see the specifications in Appendix E.

The instrument is designed for high speed measurements with max. measuring speed of 2 to 50msec from trig to end of measurement. The speed depends on the settings. This high speed and high accuracy makes the instrument very suitable for applications where automatic testing and automatic sorting is required. The instrument has, as standard, built-in IEEE (GPIB), RS232C and handler interfaces and the instrument is therefore well suited to work in automatic sorting machines. Moreover, the ability to average the values of a (programmable) number of measurements makes it a very accurate bench-top instrument.

The standard fitted IEEE 488 (GPIB) and RS232C interfaces make it easy to control the instrument from a PC and to collect data during measurements for further evaluation on the PC. By exporting the measured data to a standard spreadsheet all kinds of statistical information may be investigated.

Maintenance and Calibration of DB502

When unpacking the instrument, you will find a calibration certificate (traceable).
Danbridge recommend you strongly to let the instrument be calibrated every 12 months in order to take advantage of the high accuracy of the equipment.

You may ship the instrument to Danbridge for calibration, or you may sign a maintenance and calibration agreement for getting the instrument calibrated on your site every 12 months.
Contact Danbridge for further information by email: service@danbridge.com

DB502 layout

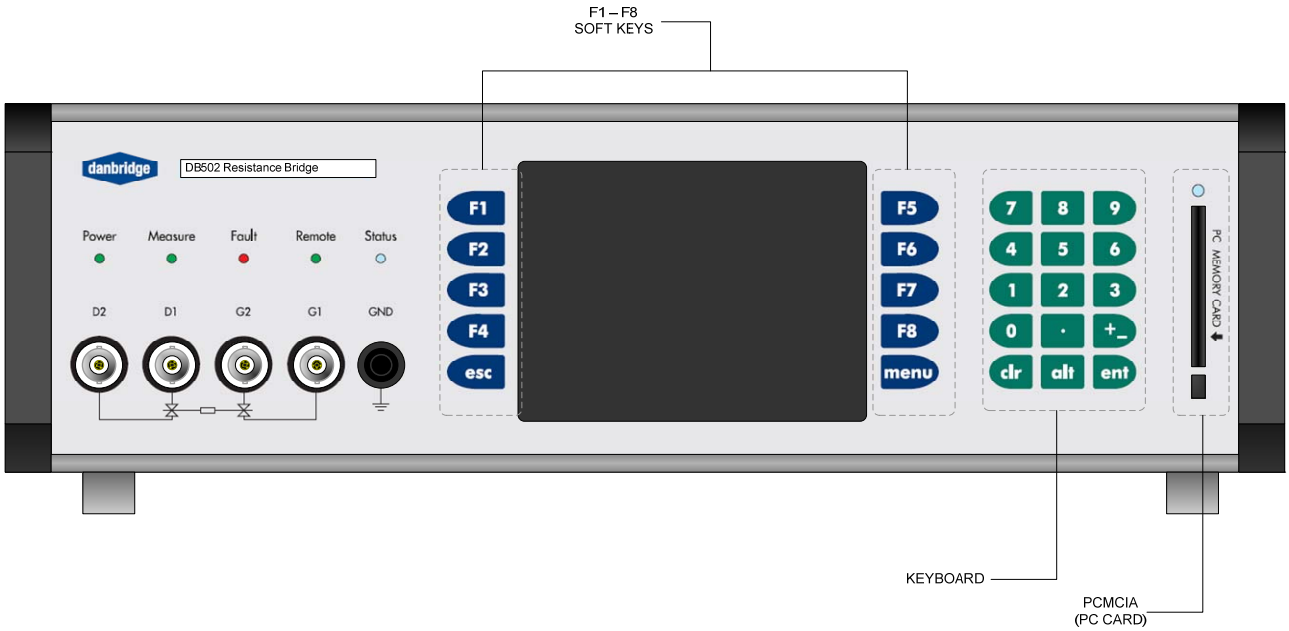

Fig. 1 DB502 Front

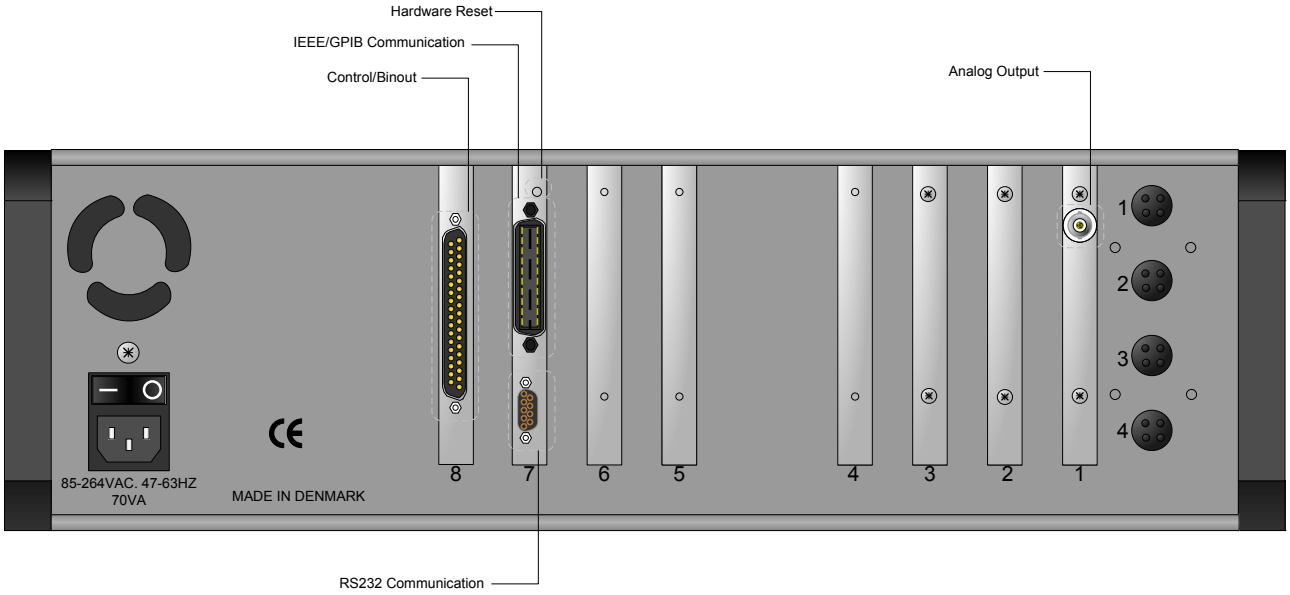

Fig. 2 DB502 Rear

Philosophy

This Manual

Please note that in this manual, keys and display labels used are marked bold and italic as in this example:

Start display
Soft key(s) around the display

(Text in the display for the actual function) (display label).

Displayed Characters and Labels

Several of the soft keys are toggle switches, meaning that they will change every second time they are activated. For instance:

Start Measure / Stop Measure

The instrument is in continuous mode (default average 100) and will measure every 250 msec (approximately).

The next time the 

is activated the measurements will stop.

The idea is that next time you, you will get what is shown in the display label.

Alternatively the situation could be

Stop measure / Start Measure

Meaning that the measuring has been started and the instrument is now waiting to be stopped again by pressing 

once.

Factory Setting

Connect the power cable to a mains outlet with a good ground connection and switch on by the mains switch on the rear panel. The built-in control lamp shows a green light, indicating that the power is on.

The DB502 starts with a memory check and the display shows DB502. When the instrument is ready to measure the TRIG menu becomes available in the display. It is possible to make a single trig at F1 and continuous trig a F5.

After the instrument has passed the memory check and the first trig (F1) or F5, the DB502 will continue as prior to the power switch off.

Warm Up Time

If possible, the instrument should be switched on for at least 30 minutes before measuring. Only then is the maximum accuracy of the instrument reached.

The same 30 minutes warm up should be considered before any zero adjustment.

LEDs on the front panel

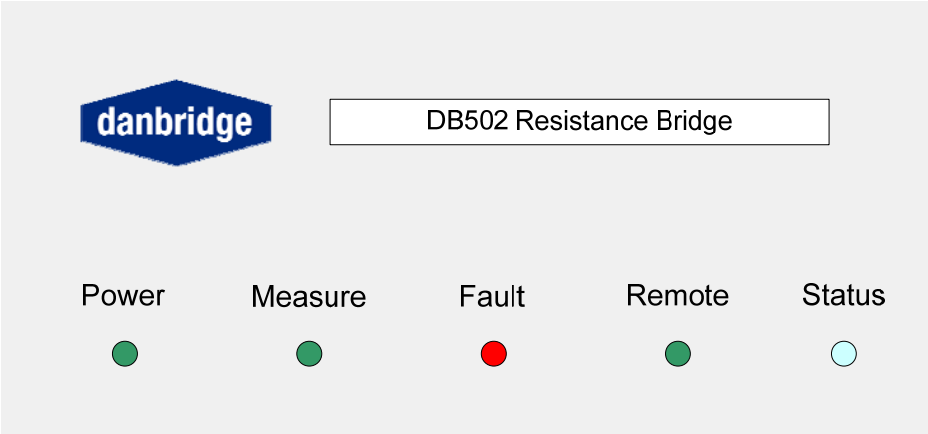

Fig. 3 Frontpanel LEDs

Power	Mains Power is on (green light) as the main switch on the rear panel has been activated.
Measure	Is on (green light) as long as the instrument is running a measurement cycle.
Fault	Is on (red light) when an external fault is detected. An external fault could for instance be a wrong component.
Remote	Is on (green) when the instrument is controlled by IEEE or RS232C
Status	Green light means OK and red light means that something is wrong, for instance jig-calibration is not yet done. he Status LED is red as long as there is no Jig zeroing stored in the memory. The reason could be that no jig zeroing has been performed since the latest software reset (or the last software update). When the Status LED is green, a successful Jig zeroing has been performed and the instrument is ready for measurements. Furthermore the status lamp is used for software updates, indicating when the new software has been stored into the flash memory (by red/green flashing). Flashing light in the status lamp after start up indicates that there might be a fault in the microprocessor during the automatic internal self test. In case this situation occurs, please contact Danbridge support department.

Installation

Please connect a suitable 4-terminal Kelvin jig to the instrument before start of measuring with DB502, for instance the optional JIG500. The fixture should be connected by means of 4 shielded cables with low parasitic loading, for instance cables like RG58U.

The test cables between the instrument and the fixture should never exceed 100cm. When using cables longer than 50cm we recommend you to use the twisted cables supplied by Danbridge. These cables will prevent unstable measurements and noise pick-up.

The cables should be connected as shown below.

Please note that the contacts in the fixture should always be of a high quality in order to measure mΩ correctly.

Warning: Do not ground the shields of the measuring cables G1 and G2

Either the shield of cable D1 or D2 may be connected to a floating shielding of the test fixture. It must not be grounded.

THE 4 CABLES SHOULD BE OF EQUAL LENGTH, AND IF THE LENGTH EXCEEDS 0,5M THE 4 CABLES MUST BE TWISTED TOGETHER

DANBRIDGE ADVICES YOU STRONGLY TO USE THE SUPPLIED SET OG TWISTED MEASURING CABLES

Principle of Operation

The DB502 uses the classic bridge configuration to perform fast, stable and accurate resistance measurements. Fig. 4 shows a simplified diagram for resistance measurement.

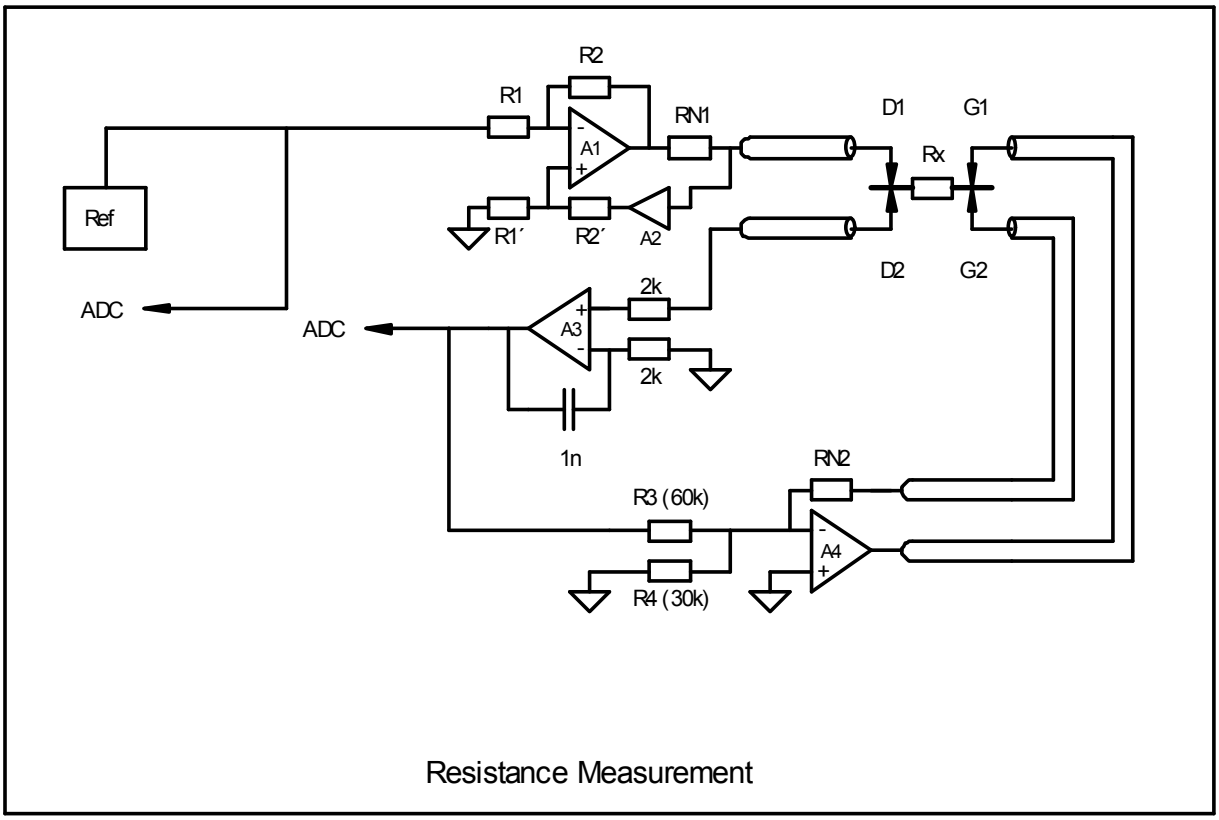

Fig. 4 Principle of operation in resistance mode

The circuit A1 is a current generator setting a fixed current flowing from G1 into D1. The circuit A4 is a voltage generator controlled by the detector A3. The detector works as an integrator keeping the voltage at D2 on zero. By means of the Analog -to Digital Converter (ADC) the reference voltage and the detector are measured. The resistance is calculated by the CPU as:

$$R_x = -\left(\frac{R1}{R2}\cdot R_{N1}\right)\cdot\left(\frac{R_{N2}}{R3}\right)\cdot\left(\frac{U_{\det}}{U_{ref}}\right) \qquad [1]$$

R1, R2 and R3 are fixed resistors. RN1 and RN2 are set by relays to the required resistance range. Hence, in resistance mode the detector voltage is proportional to the unknown resistance.

In deviation mode the setup is more complex and will not be described in details here. The result is, that the detector voltage is proportional to the relative deviation from a set (reference) value. If the reference is set to 10kohm and the resistor under test has a value of 10.026 kohm, the measurement will be displayed as "+0.26%". The DB502 can be set to 10% or 100% Full Scale Deviation.

Connecting the DB502

The DB502 performs a 4-wire resistance measurement with D1/G1 acting as generator and D2/G2 acting as sense wires. D2/G2 must therefore be connected as close to the measured resistance as possible, see fig. 5

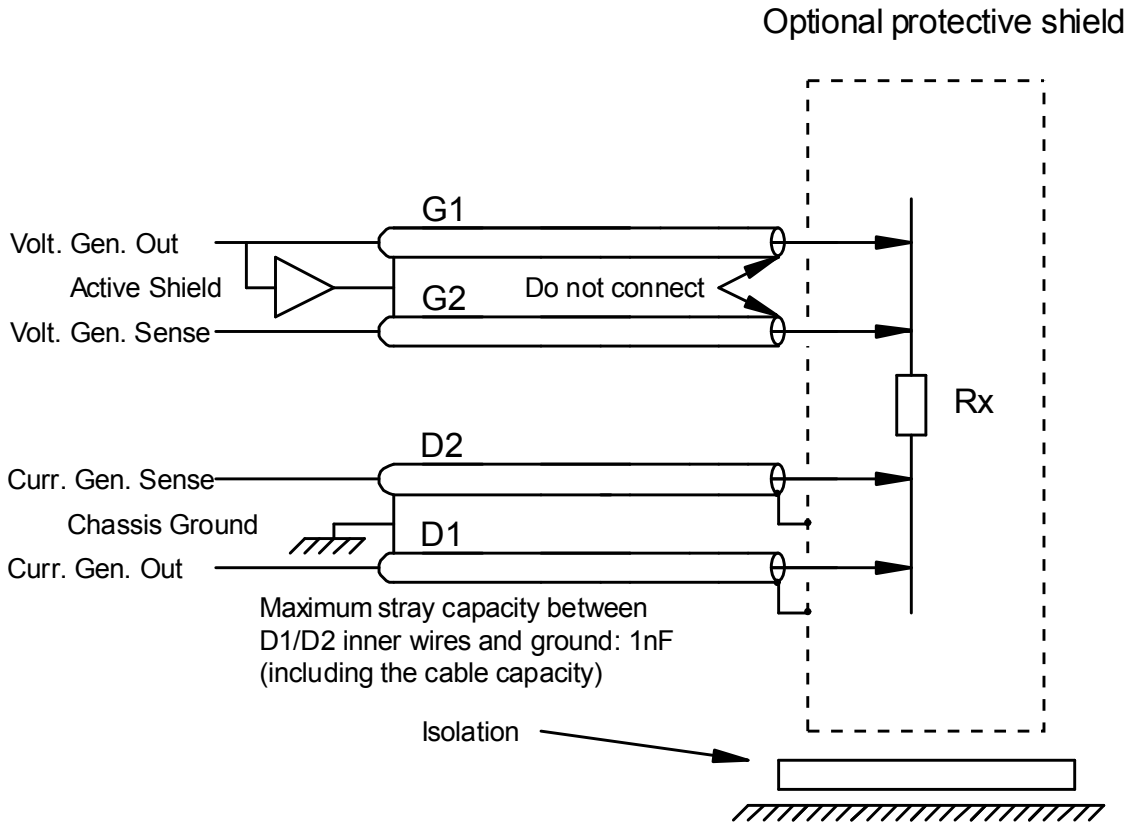

Fig. 5 Basic measure connections

In order to avoid noise pick up and hum disturbance always use as short cables as possible and keep them in parallel or twisted (all 4 of them). Also, in order to ensure stability of the measure circuit, make sure that the stray capacity between the D1/D2 signal wires and ground is below 1nF including the cable capacity. 1m/3feet of coax wire has app. 100pF between centre wire and shield.

When measuring large resistor values (> 1 - 10Mohm) special care should be taken to avoid hum injection. This could include magnetic shielding by means of a grounded iron plate under the test setup or eq. To assess the quality of the setup, do the following:

1. Connect an AC voltmeter to the analog output at the rear of the DB502 (BNC).
2. Connect a high value resistor to the setup.
3. Setup the DB502 to the mode and range in question, start and stop continuous measurement.
4. Read the AC voltage of the analog output.

The AC voltage should be well below 10mVrms, otherwise, the setup must be improved.

Menu

From the start display you may continue by selecting menu

When pressing the menu key you have access to a range of submenus and commands:

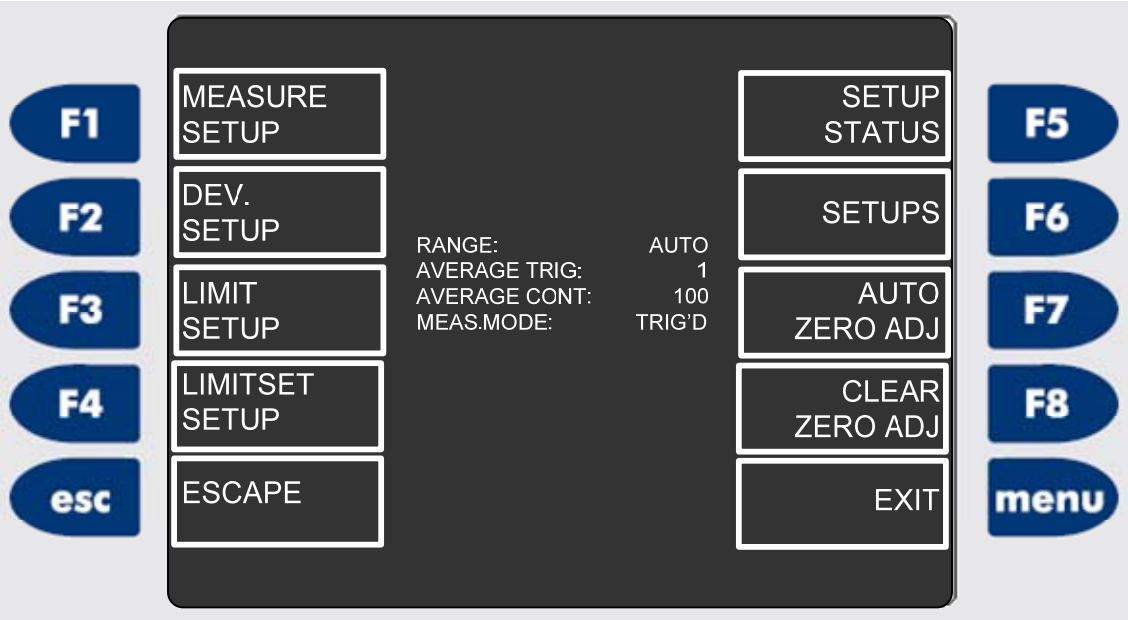

Fig. 6 Menu Display

Setup Status

If you want to check the status of the current instrument setup, please press:

menu
F5 Setup status

The status display will inform you how the instrument is setup is done:

RANGE:	AUTO
AVERAGE TRIG:	55
AVERAGE CONTinue:	75
MEASurement MODE:	TRIG'D

SMD components must also be tested in "True 4-terminal" connection.

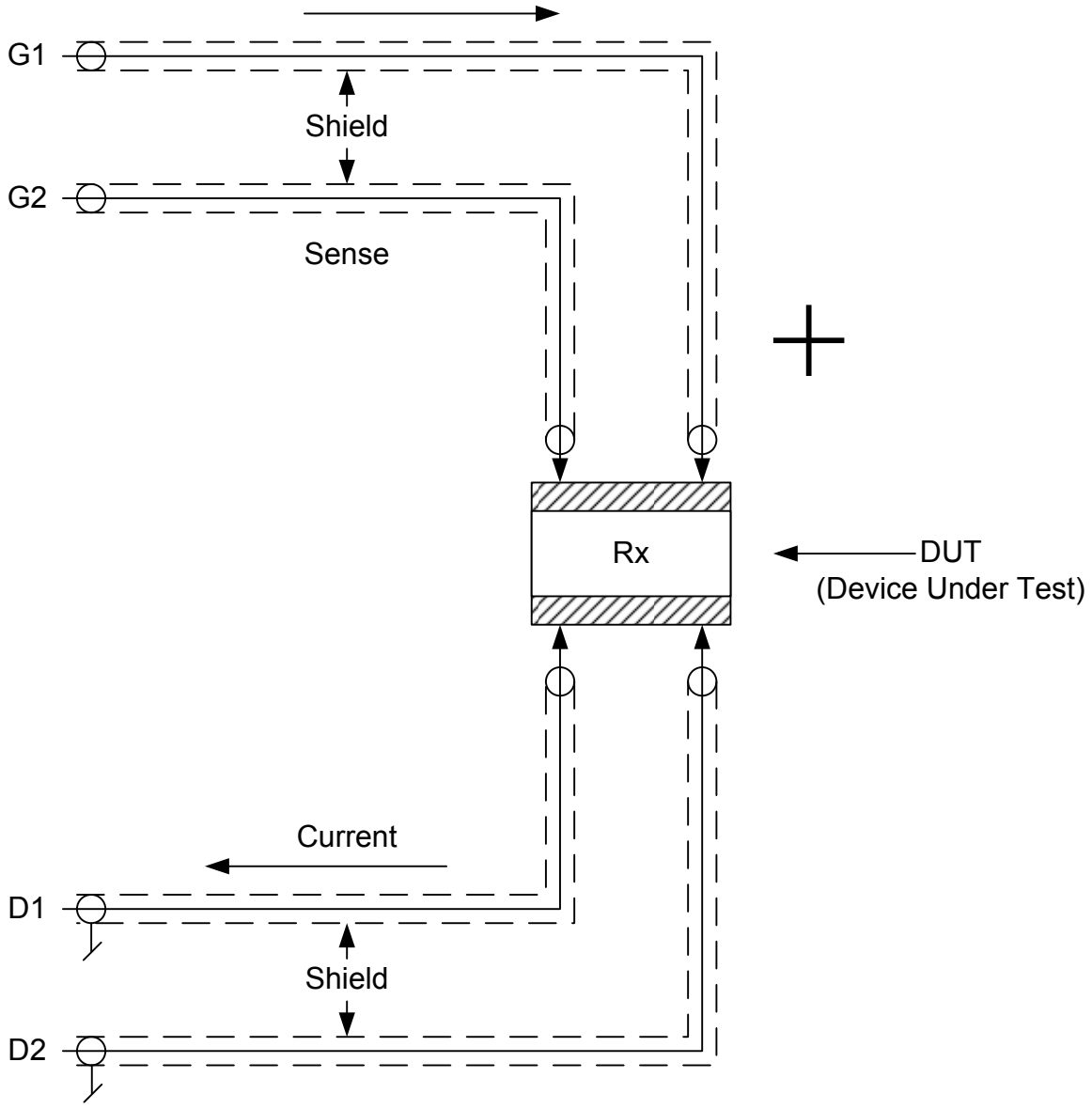

Fig. 7 Installation and connection

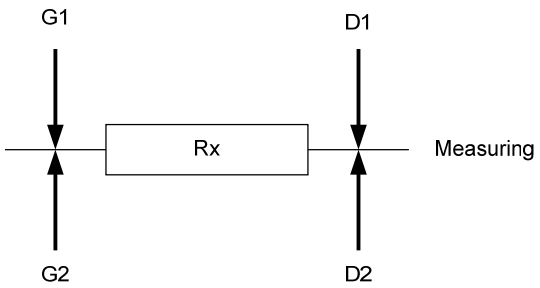

Fig. 8 Contact Connections

Zero Adjust

It is necessary to calibrate the instrument by Jig zero the fixture before any measurements are made with the DB502. Also when the status lamp on the front panel is red, please calibrate as described below.

Please remove any components from the fixture. Make sure the 4 Kelvin contacts are shorted as shown on the sketch below.

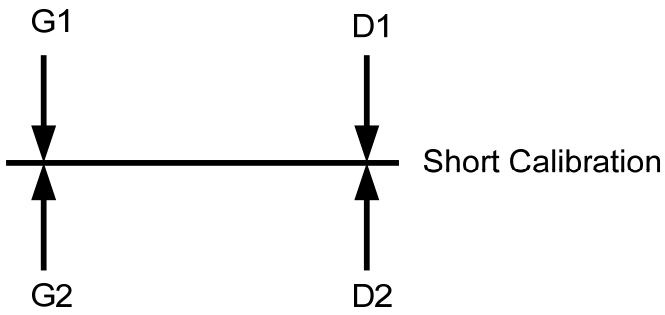

Fig. 9 Short calibration

Press menu F7 for jig zero adjust.

Shorting device

During the short jig zeroing, the words "***Zero Adj. Running***" are shown in the display.
When finished
After more than 1 minute, "***Zero Adj. Ended"*** will be seen. See the figures on the next page.

Due to the very accurate zero adjustments in all ranges, the jig zeroing lasts approximately 30 sec. However the calculation has a preset from the previous making it sure it will start calculation as close as possible to the likely values in order to speed up the process.

During the calibration process, please keep away from the neighbourhood of the fixture as influence from the operator may harm the calibration.

Please note that the status lamp will show red light when the jig is not zero adjusted, but the Status lamp will change to green light after a successful jig zero adjustment. See next page.

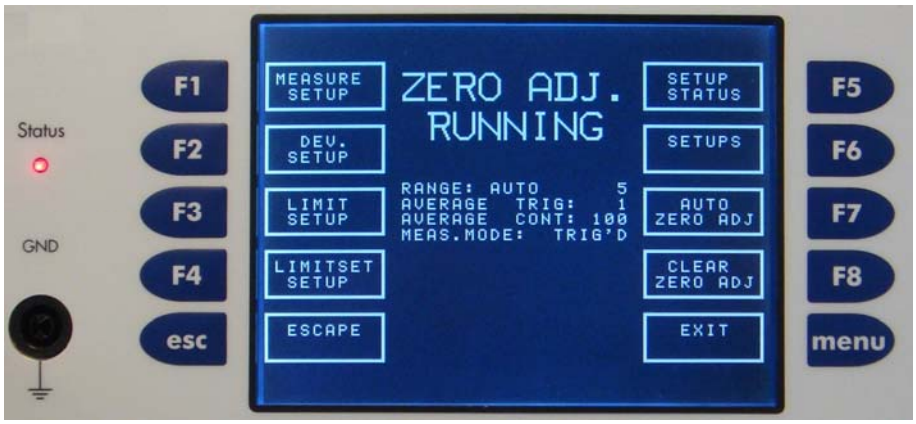

Fig. 10 Zero Adjust running

Fig. 11 Zero Adjust Eended

When zero adjustment has finished as shown above, the green status lamp will show green light indicating a successful zero calibration.

Clear Zero Adjust

You may remove the zero adjust offset by pressing 

Jig 500, Optional

Optional Jig for Danbridge 500 line of DC Resistance Bridges is available. Please contact Danbridge for a quotation.
Jig 500 is a 4-terminal jig for radial and axial components. As option for Jig 500 is a 4-terminal SMD fixture available. See below.

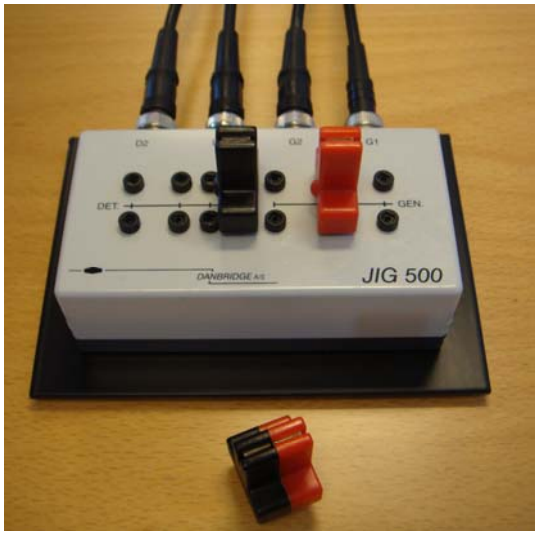

Fig. 12 Radial and Axerial Jig

SMD fixture, Optional

When using the SMD component fixture it is also essential to perform the Jig calibration process. The operation is technically the same as described above. Due to the nature of the SMD fixture the jig calibration devices are different than on the Jig500 for axial and radial components.
When the SMD fixture is delivered from factory, 1 short device is enclosed.
The short device is a solid golden plated copper piece. This device is used for the short jig calibration, where all four terminals are shorted as described above.

Fig. 13 SMD jig

Measure Setup

Start Measuring

When the instrument has been switched on and a sufficient 4-terminal Kelvin fixture has been connected, you may insert a component for testing.
(Please make sure that the short calibration has been performed)

When you, are testing a resistor and have made sure that the resistor is sufficiently connected to the 4-terminal fixture, you may press 

for trig or 

for continuous measurements.

Trig Delay

The time from Trig to the start of measurement can be programmed from
Zero to 99msec. This Trig Delay is used to avoid range changes due to contacts which are not completely stable when the Trig signal arrives.

The Trig Delay is entered by pressing:

MEASURE SETUP

AVERAGE/TRIG

TRIG DELAY

Trig mode (from front panel)

is used for single trig measurement

Continuous mode

is, like several of the soft keys, a toggle switch, meaning that it will change function and label every second time it is activated. For instance:

Start Measure

By activating the key the instrument will go into continuous mode and start measuring and the label on the display will show the next possibility:

Stop Measure

When the instrument is in continuous mode, it will measure continuously. Next time

is activated the measurements will stop, consequently the display will show the next possibility:

Start Measure

Meaning that the measuring has been stopped and the instrument is now waiting to be started again by pressing either 

(trig) or 

once

By connecting a component to the 4 terminal fixture, the component values may be measured, as described above. The results will appear in the display as shown in fig. 14

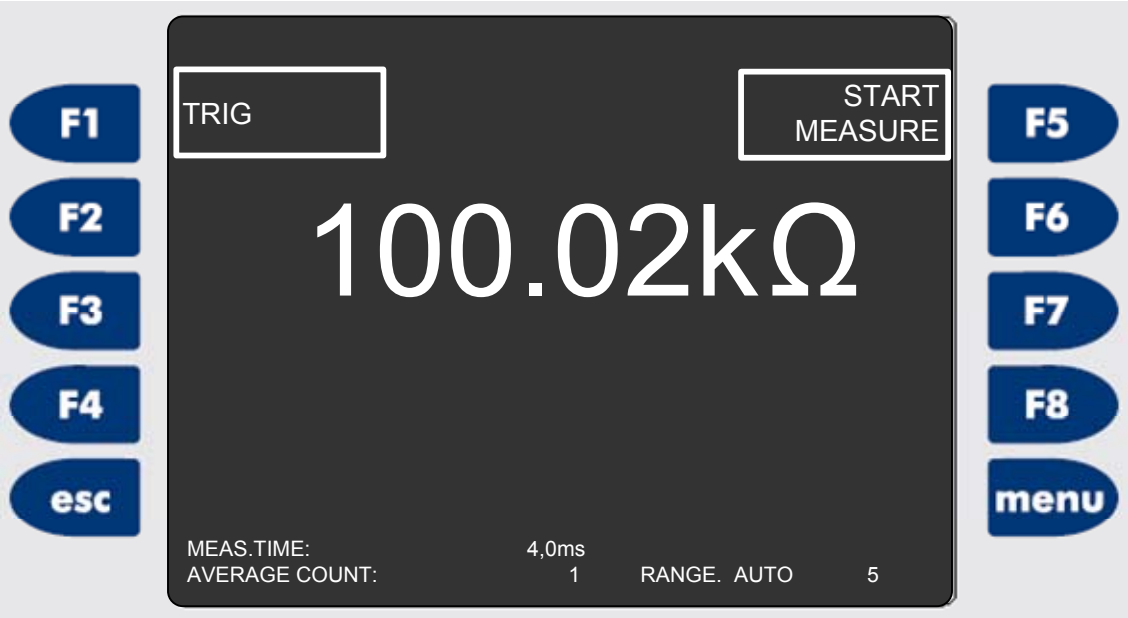

Fig. 14 Measure Display

Measure Timing

General

When a measurement is triggered (whether internal or external) the internal reference is measured and then the detector voltage is measured n times. n is the average count. Then the result is averaged and calculated. If Data Transmission is ON the result is transmitted via the chosen bus. If an average count is set to a multiple of 10, i.e. 10, 20, 30 etc., the DB502 will automatically go into HUM REJECTION MODE. Select the relevant Mains Power frequency to be rejected with the 50Hz/60Hz soft key. Use an average count of 10 (or more) giving a measuring time of 23 msec. in TRIG MODE in order to obtain the maximum accuracy.

Contact Check

This function measures the contact resistance in the test leads from G1 to G2 and D1 to D2. The Contact Check test level should be set to a value between 40 and 80 and Contact Check must be activated from the Measure Setup menu. The Contact Check function returns "GGG..." or "DDD..." according to the failing set of contacts.

Tracking of line frequency for hum reject

The purpose of the line frequency tracking is to ensure that there are exactly one period of line frequency between the samples. Hereby hum injection can be efficiently rejected. A Phase Locked Loop is used to track the internal clock signals to the line frequency. A microprocessor controlled timer checks that the time period between the samples is within ± 2 msec of the nominal value of the line frequency (20 msec or 16.7 msec). If this condition is not satisfied, the measurement is aborted and "NNN..." is returned in the display. Tracking of the line frequency is only active in "Fast Thermo Voltage Rejection" mode.

Normal Mode

This figure shows the timing diagram for RS232:

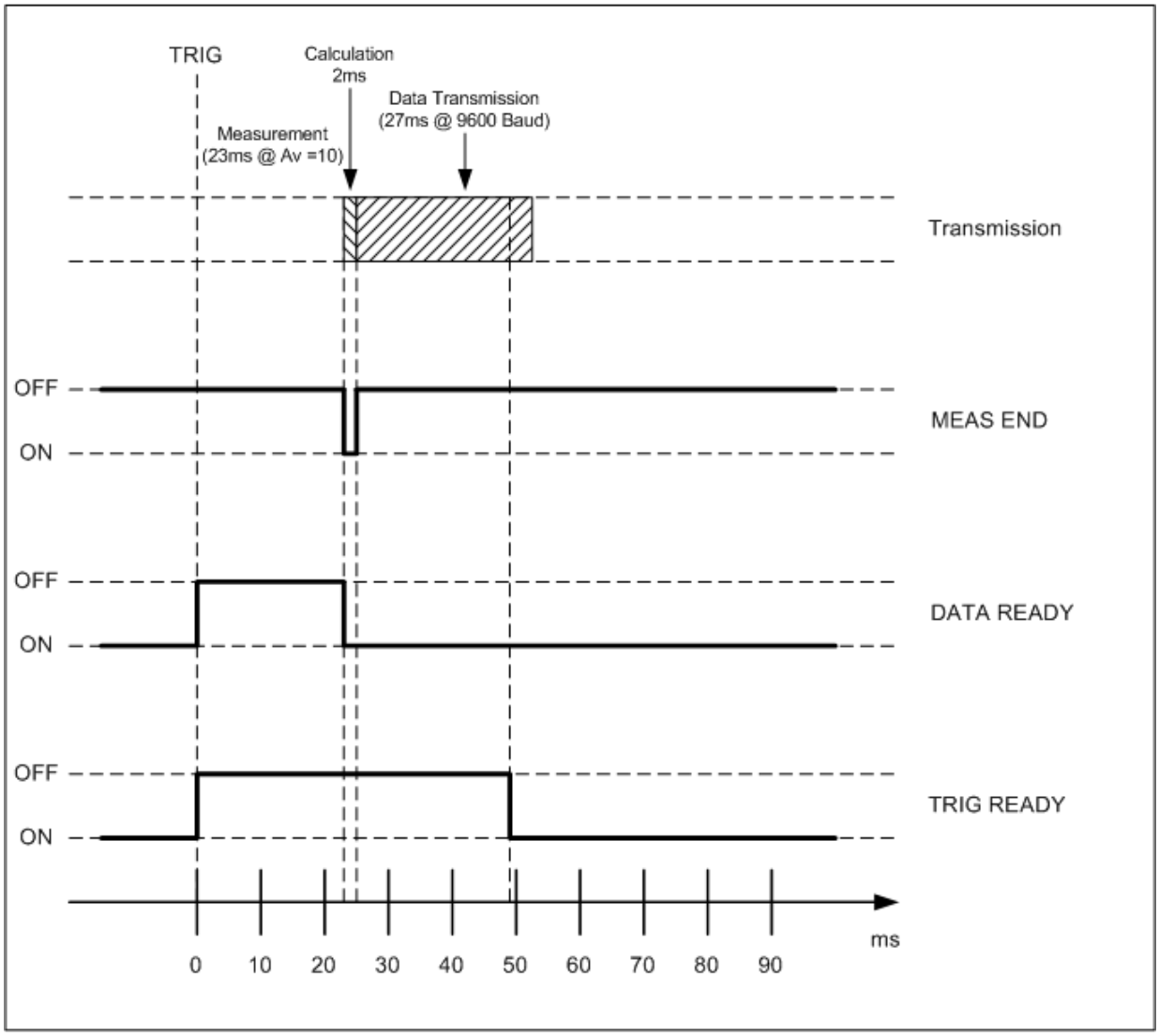

Fig. 15 RS232 timing diagram

The measuring time in TRIG MODE is the time from the trigger is applied (and the jig-contacts are stable) until the MEAS END signal appears on the rear panel (after which the resistor may be removed from the jig). Approximately 2 msec. later the MEAS END is OFF again. When the MEAS END goes OFF the DATA READY goes ON. The LIMIT OUTPUT is now stable and the DB502 will start transmitting DATA (if the data transmission is not disabled, see BUS I/O SETUP). In RS232 mode the transmission time at a baud rate of 9600 (default) will be approximately 27 msec The TRIG READY signal goes ON when the last byte is transmitted.

This figure shows the timing diagram for IEEE:

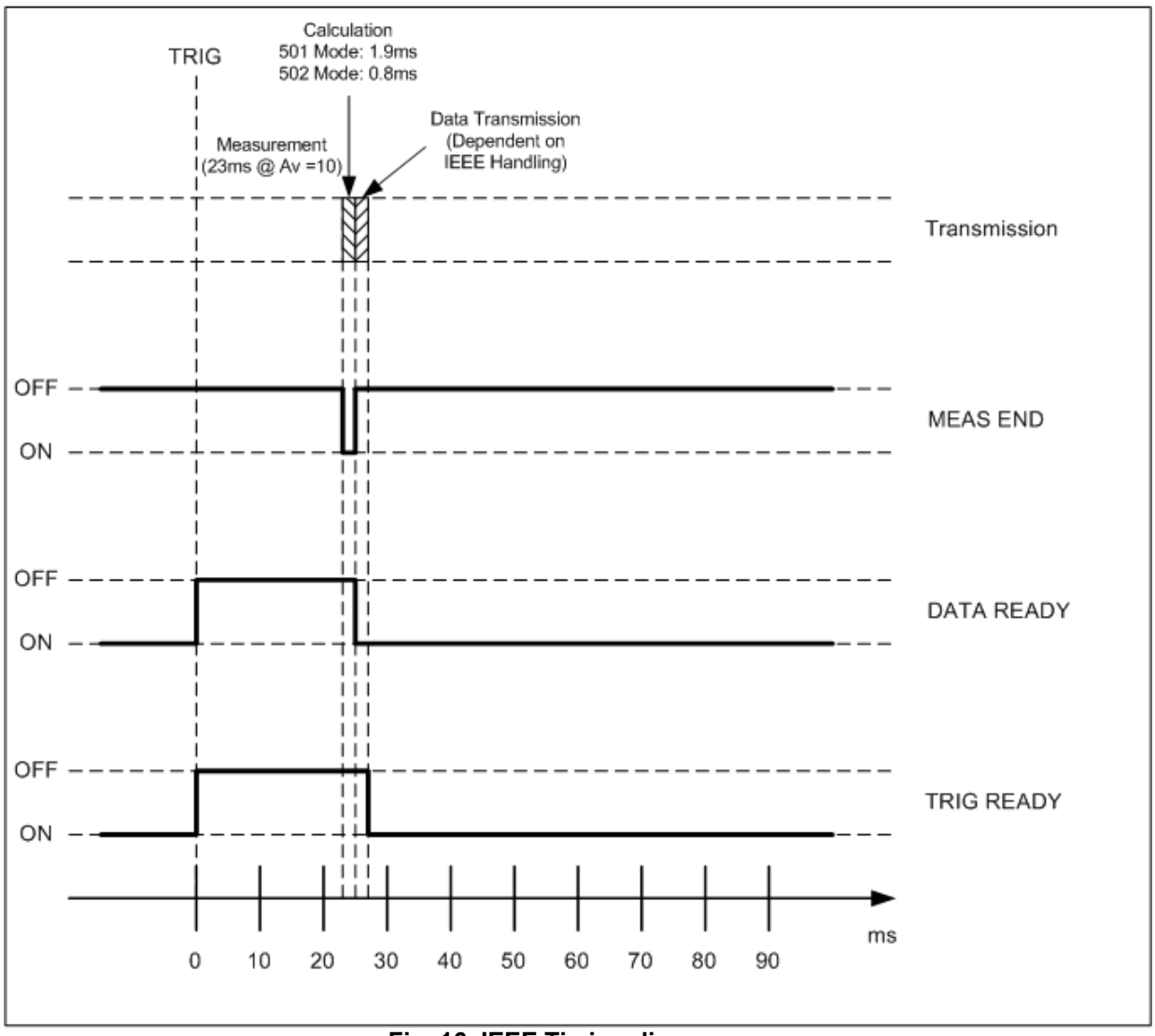

Fig. 16 IEEE Timing diagram

The transmission time depends mostly on the IEEE handling of data.

The measuring time, defined as the maximum time from TRIG to MEAS END, may be calculated as:

t = 3 msec + n * 2 msec (50Hz)

and

t = 3 msec + n * 1.67 msec (60Hz)

Thermo Voltage Compensation (TVC) Normal

Thermo voltage may cause severe measuring errors when measuring low value resistors (less than 10 ohm) because of the low measuring voltage applied. The DB502 can compensate for thermo voltages in the test leads and the connections to the resistor under test by entering a special Thermo Voltage Compensation (TVC) Mode. When the Thermo voltage compensation is ON, the DB502 begins the measuring cycle by performing n (n = 1 -100 depending on the average count) measurements with the Voltage Generator (VG) switched OFF. Then the VG is switched ON and after a wait period of 20 msec (or 16.7 msec depending on the selected mains reject) n new measurements are performed. The results from the first measurements are then subtracted from the results of the corresponding last measurements before the average of the measuring results and the final calculations.

N.B.! The Thermo voltage compensation should only be used on low value resistors in order to avoid unnecessary wearing out of the two relays which have to be switched ON and OFF once for each measuring cycle.

In TVC Normal the timing correspond to the figures .....but the measure time is calculated as follows:

t = 23 msec + n * 4 msec (50Hz)

and

t = 19.7 msec + n * 3.33 msec (60Hz)

Thermo Voltage Compensation (TVC) Fast

t = 20 msec + n * 0.4 msec (50Hz)

and

t = 17 msec + n * 0.4 msec (60Hz)

High Speed Mode

t = 1 msec + n * 0.32 msec (50Hz)

and

t = 19.7 msec + n * 0.267 msec (60Hz)

Measuring Mode Comparison

The figure shows the measure time of the different measuring modes as function of average count.

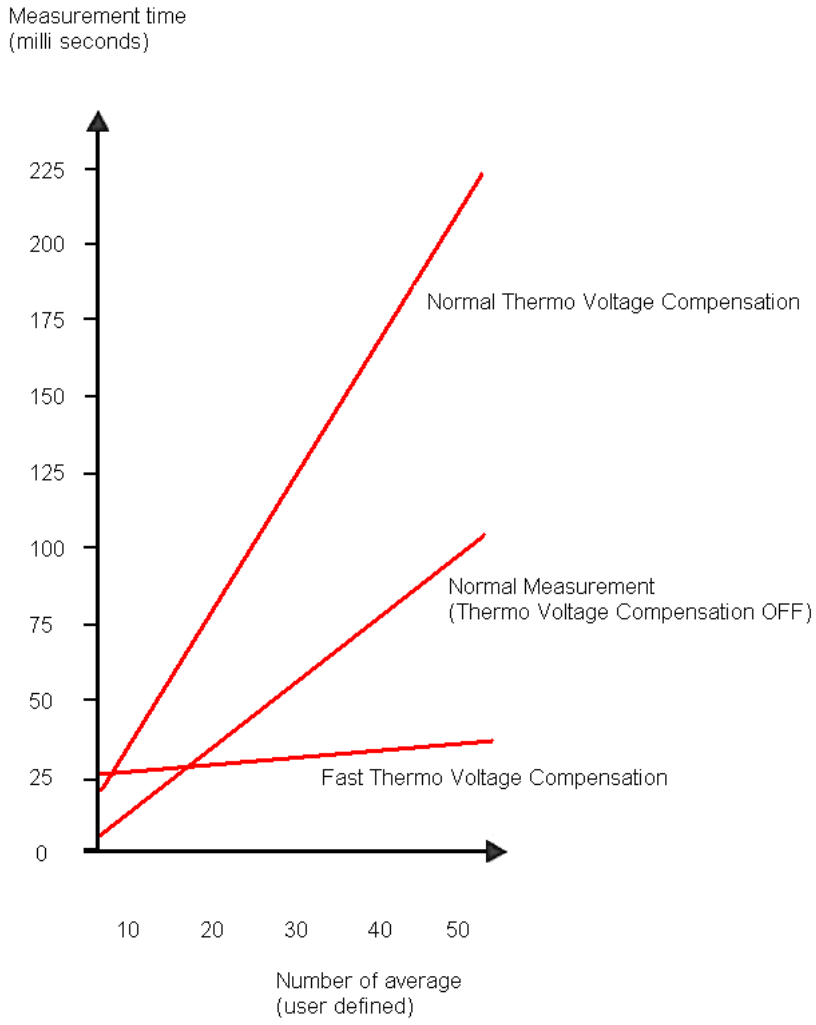

Fig. 17 Measure Comparison

Average Count

When measuring in continuous mode the default average is set by the internal software to 100 in order to ensure a stable and easy to read measurement. Alternatively, the average count value may be set by the operator. Values between 1 and 100 are accepted when not using fast mode. In fast mode the limits are dependant on the reject frequency and range.

Limitations on average in fast thermo compensation mode:

Range 1 – 9: 50Hz max average is 75, and 55 in 60Hz
Range 10–11: 50Hz max average is 50, and 30 in 60Hz

By using from 2 and up to 100, electrical noise and hum may be minimised. We advice to keep the average count as high as possible, in order to reduce influence from external electrical noise. A too high value will be inconvenient in many applications. An acceptable value should be chosen as a trade off between stability and measuring time.

The average count is changed as follows.

Measure Setup

Average / Trig

Not in use

Trig delay

Not in use

Not in use

Average on Cont

Average on Trig

Select the required number of average count (1 to 100) by using the numeric keyboard and when finished press 

and you will return to the main menu.

If you need to correct the average count number selected, use 

Escape will return you to the main screen.

Exit may step backwards step by step.

Average in 501 mode

Note: the maximum average count is 100. Average count for CONTINUOUS MODE, is default 100 but can be changed.

If an average count is set to a multiple of 10. i.e. 10, 20, 30 etc., the DB502 in DB501 mode will automatically go into HUM REJECTION MODE. Select the relevant Mains Power frequency to be rejected with the 50Hz/60Hz soft key.

Use an average of 10 (or more) giving a measuring time of 23 msec. in TRIG MODE in order to obtain the maximum accuracy.

The measuring time in TRIG MODE is the time from the trigger is applied (and the jig-contacts are stable) until the MEAS END signal appears on the rear panel (after which the resistor may be removed from the jig).

Approximately 2 msec. later the MEAS END is OFF again.

Range Selection

Please note: The highest accuracy is obtained by using 10% deviation mode.

Absolute measuring mode

Ranges may be selected manually (fixed range) or automatically (auto range).
When running the instrument in Trig mode, measuring absolute values, for instance on an automatic sorting machine, it is advisable to use the fixed range as the total time for measuring one component is shorted significantly by letting the instrument know the range which should be used.

Using auto range, the instrument needs to seek for the correct range and by this adding extra time to the measuring cycle. Therefore, auto range will normally be used only in continuous mode.

See range specification in Appendix B.

Deviation measuring mode

When running the instrument in deviation mode, using a nominal value, the DB502 will always start in the correct range in accordance with the nominal value.

See range specification in Appendix B.

The ranges may be selected by using soft keys:

Measure Setup

Range

Range up

Range down

Range auto

Range lock on

Escape will return you to the main screen.

Exit may step backwards step by step.

Deviation Measurements

Switch on the DB502 and press menu

The start display will change to the measure setup display, where F2 will give access to the deviation display:

F2 ***Deviation Setup*** Will give you access to measure related menus such as:

F1	***Enable deviation***	Switch off / on deviation measuring mode (toggle function)
F2	***Type Resistance***	Select R deviation
F3	***Type 100% F.S.***	100% full scale % deviation
F4	***Type 10% F.S.***	10% full scale % deviation
F5	***10% FS ABS Resi***	10% full scale absolute resistance deviation
F6	***Nominal value***	Let you program the nominal value
F7	***Delete Nom val***	Delete nominal value
F8	***Not in use***	

esc ***Escape*** Will let you escape the present settings without storing the settings or let you jump back to the measure display in one step.

F8 ***Exit*** Let you step backwards one by one step

The soft keys F1, to F7 will activate the above mentioned functions when pressed.

F6 ***Nominal value***

Type the required nominal value of the resistor you want to test by using the numeric keyboard and select the Ω. Then finish by pressing ent and you will return to the main menu.

If you need to correct the nominal value while typing; use clr

esc Escape will return you to the main screen.

menu Exit may step backwards step by step.

Limits

The DB502 can sort components into 13 bins (BIN0 to BIN12) on resistance.

There are two types of primary limits available in the DB502, Absolute limits and Deviation limits.

Resistance limits must always start with LIM0, if LIM0 is deleted all primary limits in the Limit set are deleted.

Absolute limits:

Enter the values of the limits, starting with Lim0 by Edit LIM0, select ABSOLUTE LIMITS, and enter the values. The limits must be increasing in values, otherwise they are ignored.

Deviation limits:

When a nominal value has been programmed and Deviation mode activated (see deviation) it is possible to let the DB502 run in Limit mode with limits relative to the nominal value either in absolute deviation or in percentage deviation.

Edit LIM0, select LIMITS and ABS (for absolute deviation) or PERCENT. Again the limits must be increasing in values otherwise they are ignored.

LIM0: -1.0 kΩ, LIM1: 1.0 kΩ with a nominal value of 10.000 Ω will sort
Resistors with R < 9.000 Ω in BIN0 (Low Reject), 9.000 Ω < R 11.000 Ω in BIN1 and R > 11.000 Ω in BIN12 (High Reject).

LIM0: -10% and LIM1 10% with a 10.000 Ω will sort in the same bins as above.

Limit Setup

When a nominal value has been programmed (see deviation) it is possible to let the DB502 run in limit mode sorting out the measured components in 13 bins for the R parameter.

The limits are easily programmed by pressing:

menu
F3
Limit setup

F3	***Limit setup***	Will give you access to the limit programming menu:
F1	***Activate limits***	Will switch on/off any selected bin mode
F2	***Edit limit***	You may edit a selected limit
F3	***Delete limit***	You may delete a selected limit
F4	***Not in use***	
F5	***Previous limit***	You may go backwards to select a limit
F6	***Next limit***	You may go forwards to select a limit
F7	***Not in use***	
F8	***Bin out cont on***	Selects continuous measurements in manual sorting.
esc	***Escape***	Will let you escape the present settings and let you jump back to the measure display in one step.
menu	***Exit***	Let you step backwards one by one step

Limit set - setup

When a set of limits has been programmed, you may save the limit set in one of 5 positions for later retrieval.

This function will save much time for you during your daily routine as one limit set may be recalled and re-used so instead of creating new limits all the time you may load a limit set in few seconds.

menu
F4
Limit set setup

F4	Limit set setup	Will give you access to the limit set save and recall menu:
F1	Save limit set	You may save a limit set in position 1 to 5
F2	Recall limit set	You may recall a limit set from position 1 to 5
F3	Delete limit set	You may delete a selected limit set
F4	Not in use	
F5	Previous limit set	You may go backwards to select a limit set
F6	Next limit	You may go forwards to select a limit set
F7	Not in use	
F8	Not in use	
esc	Escape	Will let you escape the present settings and let you jump back to the measure display in one step.
menu	Exit	Let you step backwards one by one step

Limit and Control I/O on the Rear Panel (slot 8)

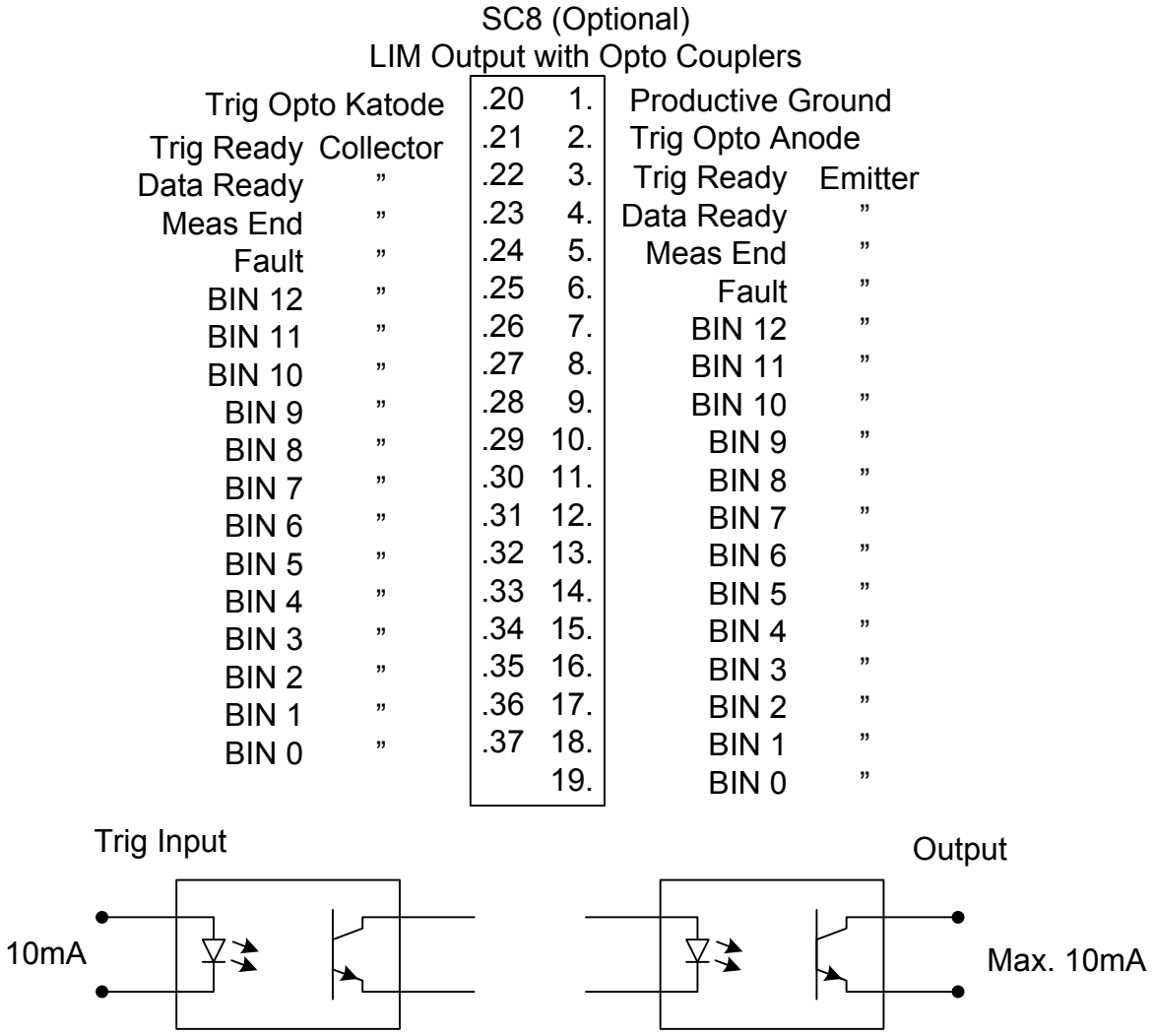

Fig. 18 Limit and Control I/O (slot 8)

DB502 as replacement of DB501

The DB502 can replace DB501 in most applications. Concerning communication and control this is done by setting the DB502 in "DB501-mode". The DB501 Limit and Control I/O interface has been delivered in two versions: open collector over a DSUB25 and optocoupler over a DSUB37. DB502 is identical to the later. If the DB502 replaces a DB501 with open collector output, the interface electronics must be reassessed. **Fig. 18** shows the translation between open collector and optocoupler connectors.

Table 1: Limit and Control I/O connectors.

DB501 and DB502 Opto Coupl. BINOUT DSUB37		Name	DB501 only Open Coll. BINOUT DSUB25 [1)]	
Pin	Type		Type	Pin
1		Chassis		25
2	An (Opto In)	Trig	An (Opto In)	19
3	E (Opto Out)	Trig Ready	E (Open C.Out)	21, 22, 23
4	E (Opto Out)	Data Ready	E (Open C.Out)	21, 22, 23
5	E (Opto Out)	Meas End	E (Open C.Out)	21, 22, 23
6	E (Opto Out)	Fault	E (Open C.Out)	21, 22, 23
7	E (Opto Out)	BIN12	E (Open C.Out)	21, 22, 23
8	E (Opto Out)	BIN11	E (Open C.Out)	21, 22, 23
9	E (Opto Out)	BIN10	E (Open C.Out)	21, 22, 23
10	E (Opto Out)	BIN9	E (Open C.Out)	21, 22, 23
11	E (Opto Out)	BIN8	E (Open C.Out)	21, 22, 23
12	E (Opto Out)	BIN7	E (Open C.Out)	21, 22, 23
13	E (Opto Out)	BIN6	E (Open C.Out)	21, 22, 23
14	E (Opto Out)	BIN5	E (Open C.Out)	21, 22, 23
15	E (Opto Out)	BIN4	E (Open C.Out)	21, 22, 23
16	E (Opto Out)	BIN3	E (Open C.Out)	21, 22, 23
17	E (Opto Out)	BIN2	E (Open C.Out)	21, 22, 23
18	E (Opto Out)	BIN1	E (Open C.Out)	21, 22, 23
19	E (Opto Out)	BIN0	E (Open C.Out)	21, 22, 23
20	Cath (Opto In)	Trig	Cath (Opto In)	20
21	C (Opto Out)	Trig Ready	C (Open C. Out)	18
22	C (Opto Out)	Data Ready	C (Open C. Out)	17
23	C (Opto Out)	Meas End	C (Open C. Out)	16
24	C (Opto Out)	Fault	C (Open C. Out)	15
25	C (Opto Out)	BIN12	C (Open C. Out)	13
26	C (Opto Out)	BIN11	C (Open C. Out)	12
27	C (Opto Out)	BIN10	C (Open C. Out)	11
28	C (Opto Out)	BIN9	C (Open C. Out)	10
29	C (Opto Out)	BIN8	C (Open C. Out)	9
30	C (Opto Out)	BIN7	C (Open C. Out)	8
31	C (Opto Out)	BIN6	C (Open C. Out)	7
32	C (Opto Out)	BIN5	C (Open C. Out)	6
33	C (Opto Out)	BIN4	C (Open C. Out)	5
34	C (Opto Out)	BIN3	C (Open C. Out)	4
35	C (Opto Out)	BIN2	C (Open C. Out)	3
36	C (Opto Out)	BIN1	C (Open C. Out)	2
37	C (Opto Out)	BIN0	C (Open C. Out)	1

1): Pin 14 (Common +) and Pin 24 (Reserved Output) not used-

The optocoupler Trig input triggers the DB502 by an input current of 10mA (maximum 30mA forward and maximum 6V reverse).
The optocoupler outputs are rated 25V and 10mA each

Special functions

Measuring Voltage Setting

The DB502 will set the measuring voltage automatically in accordance with the nominal value selected.

CONTACT CHECK:

Measure setup

Contact check on

Contact check level

Escape will return you to the main screen.

Exit may step backwards step by step.

The Contact Check function will test after each measurement in order to check if there are connections between the G1 terminal to the G2 terminal and between the D1 terminal to the D2 terminal. In other words to check if one of the 4 measure cables is broken or if one of the fixture contacts fail.

Bus and I/O setting

The alt menu gives access to several facilities and sub menus:

Bus I/O setup menu with several facilities

IEEE setup
(bus address, EOI & TON setting)

RS232 setup
(baud rate, data bits, parity and TON)

Select data out
toggle switch for switching data output on / off

Select IEEE / RS232
(toggle switch for selecting IEEE or RS232)

501 mode on/off
(toggle switch for letting the instrument communicate as the instrument DB501 or the DB502 mode. Recommended for new designs)

Continuous data out on/off

Format printer

LIM output on/off

Reset the DB502

The program in the DB502 may be reset in two ways:

Software reset from the front panel, using the keyboard by pressing:

Alt display with several facilities

Reset

Hardware reset from the rear panel, by pressing the reset switch placed just above the IEEE socket. Locate the hole in the rear panel and use a pencil or similar to activate the hardware reset key. Fig. 2 DB502 Rear for location

When using the hardware reset, the instrument must be switched on.

Warning

Please note that software reset will delete all data, Bin settings, Setup, etc.

The RAM memory will be totally cleared by reset

Test Program

In order to go into the test software, please use the keyboard and press:

Alt display with several facilities

Test Program

By pressing the above mentioned keys, you will open the Test Software.

This Test Software is intended for service and calibration of the instrument.

Warning

It is not advisable to go into this part of the program as the risk of loosing the entire basic calibration is quite high. Therefore please note this part of the program is available, but interaction should normally be avoided.

Display Setup

The display is a LCD type and these types of displays do have a limited display angle.
If you want to change this angle or you prefer to see the display inverse (black on white) you may adjust the display as you like by using the keyboard and pressing:

Alt display with several facilities

Display Setup

By pressing the above mentioned keys you will open the Display Setup display, where you may press:

Not in use

Cancel Display

The display will return when pressing 

Normal display / Extended 1 display

Display, White on Black

This soft key is a toggle switch that changes the display to what is stated on the label on the display every second time the key is activated. Consequently the display will change to the opposite by pressing again:

Display Contrast
Display contrast may change by temperature and may be adjusted by

Default value is C+00 but this may be adjusted by pressing

Display Contrast +

Display Contrast -

Display Contrast Clear
(Will reset the selected value contrast to default C+00)
Reset from the front panel or by remote control will also set the display value to default C+00

PC Memory Card

The PC Memory Card is used for software updating. A complete update requires two PC Cards containing software for the Measurement CPU (MCPU) and for the Control CPU (CCPU).

Insert the PC Card with the new software in the slot starting with the Measurement CPU (MAxx).

Alt display with several facilities.

SOFTWARE RELEASE

SOFTWARE UPDATE

The DB502 will display which CPU will be updated, the yellow Power ON LED above the PC Card will light up shortly and:

"Warning
Updating Software
Please wait"

will appear on the display.

Soon after the instrument will automatically reset and will appear on the display.

Remove the PC card and the instrument is ready for use.

WARNING! The Mains Supply must not be switched off or the rear panel reset switch must not be activated, after F4 is entered and before DB502 appears in the centre of the display.

for software release CA01 and higher

"Software ready for
Update. Enter rear
panel reset switch
after Status blink."

will appear on the display.

Press the hardware reset key after the status LED has started blinking.
The DB502 is ready for use as soon as the reset switch is entered or for an update of the other CPU.

WARNING! The Mains Supply must not be switched off in the time slot from the F4 is entered until the Status LED blinks.

Serviceability

With this generation of Danbridge instruments, a major step has been taken in order to improve serviceability on the instruments.

The idea is that exchanging a PCB in the instrument, should be as easy as exchanging a board in a standard PC. The horizontal motherboard is almost without components, except for the connectors for the PCBs. Consequently all the electronic circuits are to be found on the vertical PCBs which are very easy to remove or exchange in case of any malfunction.

For further information, please check our web site: www.danbridge.com where you may find answers to your questions under "FAQ" (frequent asked questions)

Should you need technical assistance when using a Danbridge instrument please do not hesitate to contact us by email:

Technical support and service service@danbridge.com (technical questions, etc and eventual repair of equipment)

Inquires for accessories, spares, etc. sales@danbridge.com

Or you may contact Danbridge by:

Postal address:

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Lykkegaardsvej 15
DK-4000 Roskilde
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Phone: +45 4495 5522
Fax: +45 4495 4504
URL: www.danbridge.com

REMOTE CONTROL

Remote interface

There are two ways to remote control the DB502 either by IEEE 488 (GPIB) or by RS232C, furthermore the DB502 has two modes, DB502 mode (with no emulation) and the DB501 emulation mode. The emulation mode handles input and output the same way as DB501 which is an older device, and the DB501 in emulation mode accepts commands just as DB501.

WARNING: DO NOT CONNECT ANY CABLES BETWEEN THE DB502 AND A CONTROLLER WTHOUT FIRST REMOVING THE LINE CABLES, OR ELSE DAMAGE CAN BE CAUSED TO THE I/O DRIVERS.

IEEE 488 / GPIB

Functions available on the keyboard are also available on the IEEE / GPIB interface as well as the RS232C. Except the bus settings in the alt menu, it is necessary to select IEEE (GPIB) and address before it is possible to communicate with the instrument.

RS232C

All functions available via the keyboard are also available on theRS232C interface. Except the bus settings in the alt menu, it is necessary to select RS232C and serial setup before it is possible to communicate with the instrument.

From the RS232 it is possible to control the instrument with the same device dependent commands as described in the IEEE section. the list below shows the extra commands to be used with RS232.

All input data must be terminated with an LF (line feed), CR is optional.

All output data are terminated with CR LF (carriage return line feed).

IEEE

The IEEE interface is designed according to the IEEE488-1 and IEEE488-2 standards, depending on operation mode (DB502/DB502).

The list below shows the sub-set of the IEEE standard used by the DB502. See appendix C IEEE std. 488-1978 for more detailed explanations.

Identification	Function (description of capabilities)
SH1	Source Handshake
AH1	Acceptor Handshake
T5	Talker (basic talker, serial poll, talker only mode, unaddressed to talk if addressed to listen).
L4	Listener (basic listener, unaddressed to listen if addressed to talk).
SR1	Service request.
RL2	Remote/Local
DC1	Device Clear
DT1	Device Trigger

To enter setup of
BUS ADDRESS, TON MODE and EOI on/off see manual operation section.

The first time the DB502 is addressed and the REN line is on, it will go into remote, and the remote LED on the front panel will light up.

When it is in remote, all keyboard functions are disabled, except the MENU key, which is redefined as a toggle switch between the status setup display, and the measure display.

I/O handling

In DB502 mode All I/O handling is made by the input and output buffers, each buffer has a maximum capacity of 255 characters. The DB501 mode has, measurements results etc. are stored in a single buffer and should be read after a trig has been performed.

Input buffer

The input buffer has a maximum of 255 characters, if the maximum is exceeded, inputs will be lost and a command error occur.

The command ‘GET’ (group execute trigger) is executed immediately, if the input buffer is empty, otherwise it is put into the buffer queue and executed later.

Output buffer

When there is an output from the DB502 (measurement result or query) it is placed into the output buffer, the MAV bit in the STATUS BYTE REGISTER is set and a service request will occur if enabled. Because of the queue system it is possible to make triggering and read results out of synchronisation.

Therefore be careful that no result is missed, because after that the readout will always be one or more results behind. If the output buffer overflows all data stored in the output buffer will be lost, and only a part of the expected output will be transmitted.

If the DB502 is addressed as talker and the output queue is empty it will respond with an ’?’.

To clear the input and the output buffer, the ‘DCL’ (device-clear) is used.

Input format (DB502 mode)

To enter a command you must use a minimum of four characters. The command must be followed by either a '?' for a question, or a SPACE followed by data. The type of data depends of the command.

Example: NOMVAL?
NOMVAL XXX
NOMV XXX
NOMV XXX

NOTE: All characters must be in uppercase.

Input data may use fixed or floating format signed or unsigned.

Example: +1.0E+00
10E-01
0.001K

The exponent can be replaced with a mnemonic i.e. 1E+00 or 1K. according to the table below.

Definition	Mnemonic
1E+18	EX
1E+15	PE
1E+12	T
1E+9	G
1E+6	MA
1E+3	K
1E-3	M
1E-6	U
1E-9	N
1E-12	P
1E-16	F

Commands which are on/off commands as, for example, DEVIATION the data can be ON/OFF or O/1. 0/1 can be set as fixed or floating.

It is possible to put more than one command into a command string, the command then has to be separated by a ;
Example: AVERAGE 20;*TRG

All commands / strings are terminated with CR/LF and/or EOI.

If a large number of setup commands are used, it is possible to generate an input buffer overflow. A way of preventing this is always to use the short version of the commands (only the first four characters in the command name), not sending leading zeroes in the data. Use = 0/1 instead of ON/OFF and so on. Another way, is to send the command, wait for the DONE (depending on command and setting of the device) before sending the next command.

DB502 Data Output Format (DB502 mode and DB501 mode)

Output format

DB502 (and DB502 in DB501 mode) has several formats in which the user can have the measurement result presented, it depends on settings of the output and the measurement mode.

DB502 Standard output format

There are several formats available on the DB502, the output depends on the settings, partly what the measurement is, and party whatever scientific or prefix have been chosen.

The output from each measurement consist of several fields:

[Measurement output or error code][Optional bin info][termination – CR LF]

Measurement error codes:

[CONTACTG] – Contact check, No contact on G
[CONTACTD] - Contact check, No contact on D
[R OVERFLOW] – Overflow (Resistance mode)
[W OVERFLOW] – Overflow (Resistance deviation)
[P OVERFLOW] – Overflow Deviation 10%/100% FS
[R UNDERFLOW] – Underflow (Resistance mode)
[W UNDERFLOW] – Underflow (Resistance deviation)
[P UNDERFLOW] – Underflow Deviation 10%/100% FS
[RANGE] – Wrong range during trig
[INTERRUPT] – Interrupt during measurement
[NOISE] – Noise during measurement

Furthermore, the system incorporates some faults, which should never happen under normal operation. In case the DB502 reports these errors something is abnormal and should be reported. They are introduced in case parts of the system is malfunctioning.

[OVERUNDERFLOW] – Both underflow and overflow – should never happen
[FAULT] – Unknown fault – should never happen.

Measurement output values:

Scientific:

[P/W/R][spaces][numerical value][E][+/-][exponent value]

Prefix:

[P/W/R][spaces][numerical value][prefix/space][unit; PCT/OHM]

Bin info:
If limits are on, and bins being output, the bin info is attached to each measurement

[;][space][BIN][Space][nr. 0-11]

Termination:
[CR][LF] – carriage return and linefeed characters

Examples of different outputs:

R 70.113kOHM[CR][LF]
R 70.113kOHM; BIN 1[CR][LF]
R 70.113kOHM; BIN 12[CR][LF]
R 7.0113E+04; BIN 12[CR][LF]
P +1.4511E-01[CR][LF]
P +0.1473 PCT[CR][LF]
P +1.4955E-01; BIN 12[CR][LF]
P +0.1006 PCT; BIN 1[CR][LF]
P OVERFLOW[CR][LF]
P OVERFLOW; BIN 12[CR][LF]

Etc.

OTHER DATA:

Recall of the setting information. By a question command the respond data output format is the command name followed by the data and terminated with CR LF + EOI (if requested).

For instance:

COMMAND	RESPOND
RANGE?	RANGE X CR LF
AVERAGE?	AVERAGE 20.00 CR LF
AVERAGE?	AVERAGE 20 CR LF
NOMVAL?	NOMVAL 80.0K OHM CR LF

Commands which are on/off commands will reply with 0 for OFF or 1 for On.

DB501 mode Standard output format

DB501 mode output follows directions from the original DB501 in order to maintain compatibility.

Display	Function	Sign	DP	5 digits					Exp	Exp. Sign	Exponent		Line Terminator	
Direct Ω	R	N/A	.	D	D	D	D	D	E	+/-	D	D	CR	LF
Dev. R	W	+/-	.	D	D	D	D	D	E	+/-	D	D	CR	LF
Dev. %	P	+/-	.	D	D	D	D	D	E	+/-	D	D	CR	LF

Using limit output (BIN) line terminator is substituted by ”; ” (; and one space replacing LF) and then limit information.

Limit info:

B	I	N	-	D	D	CR	LF

The line terminator before the limit information may be substituted by “; ” in order to obtain the data output in one string terminated by a single “CRLF” (see data output control in table 2).
This is the default output format by data transmission without SRQ (“E9”)

Printer output:

Display	Function	Sign	5 digits + DP						Unit or %	Line Terminator	
Direct Ω	R	N/A	D	D/.	D/.	D/.	D	D	*) OHM	CR	LF
Dev. R	W	+/-	D	D/.	D/.	D/.	D	D	*) OHM	CR	LF
Dev. %	N/A	+/-	D/	D/	D/.	D/.	D	D	% N/A N/A N/A	CR	LF

*) M, K, Space or m

Limit info as above.

Service request

The service request system is made according to the IEEE488.2 standard.
Each of the below described registers has an enable register.
Decimal data is used to set the enable register in fixed or floating format.
By recall of enable or status registers, the DB502 will reply in fixed decimal format.

See figure on the following page.

Service Request register system

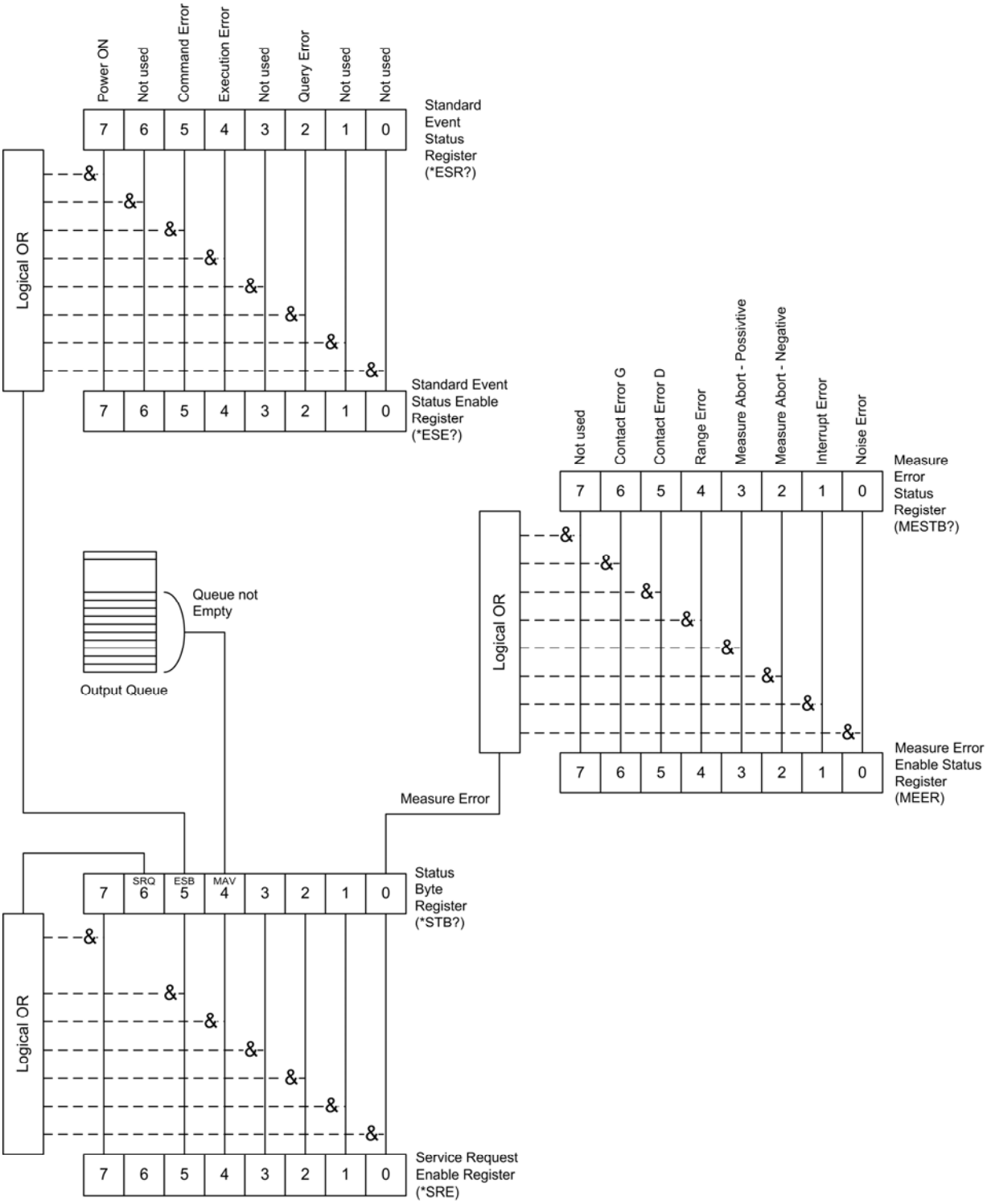


Fig. 19 Service Request Register system

STATUS BYTE REGISTER (SPOLL).

The enable register to the STATUS BYTE REGISTER is set with the command *SRE. If an event bit is true in the status byte register, and the similar bit in the mask register is true, the DB232 will generate a service request interrupt. The STATUS BYTE REGISTER is cleared by reading.

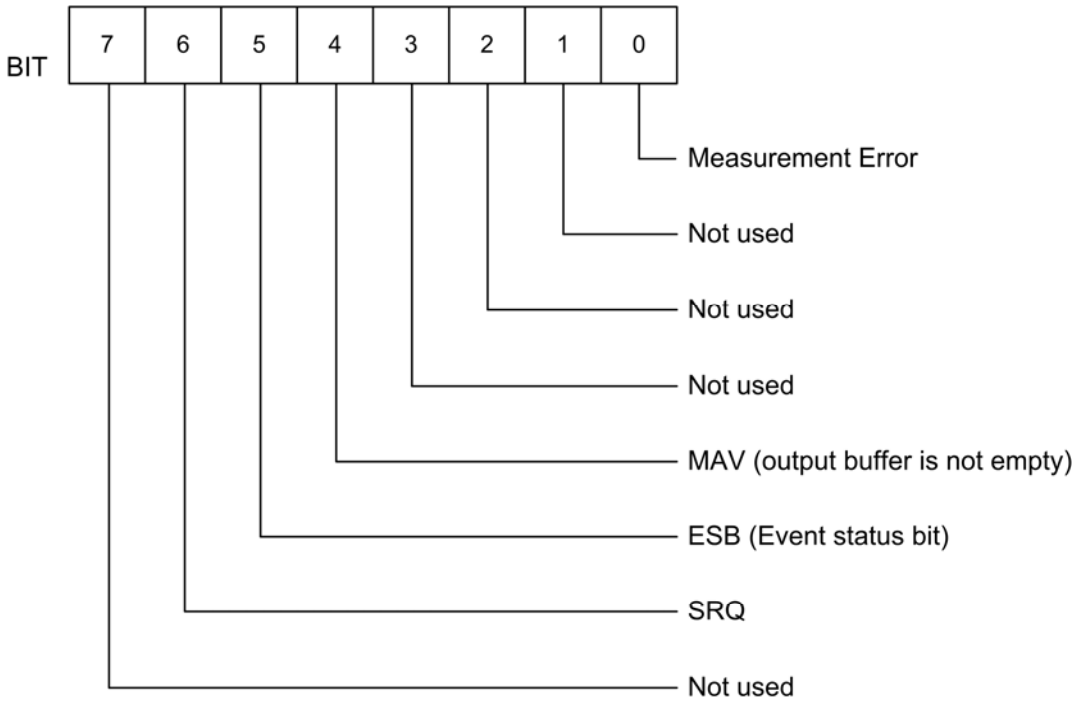


Fig. 20 Status Byte Register

STANDARD EVENT STATUS REGISTER

The enable register to the STANDARD EVENT STATUS REGISTER is set with the command *ESE. If an event bit is true in the status byte register, and the similar bit in the mask register is true, the DB502 will set the ESB bit in the STATUS BYTE REGISTER.
The STANDARD EVENT STATUS REGISTER is cleared by reading.

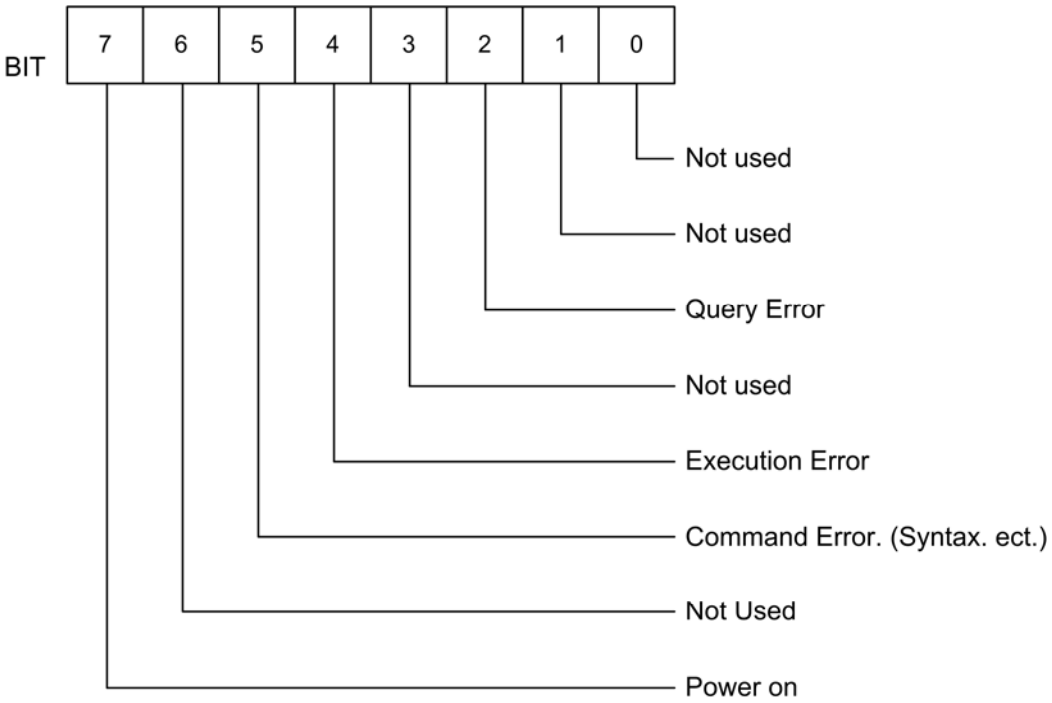


Fig. 21 Standard Event Status Register

MEASUREMENT ERROR STATUS REGISTER.

The enable register to the MEASUREMENT ERROR STATUS REGISTER is set with the command MEER. If an event bit is true in the status byte register, and the similar bit in the mask register is true, it will set the MEASUREMENT ERROR bit in the STATUS BYTE REGISTER. The MEASUREMENT ERROR STATUS REGISTER is cleared by reading (MESTB?).

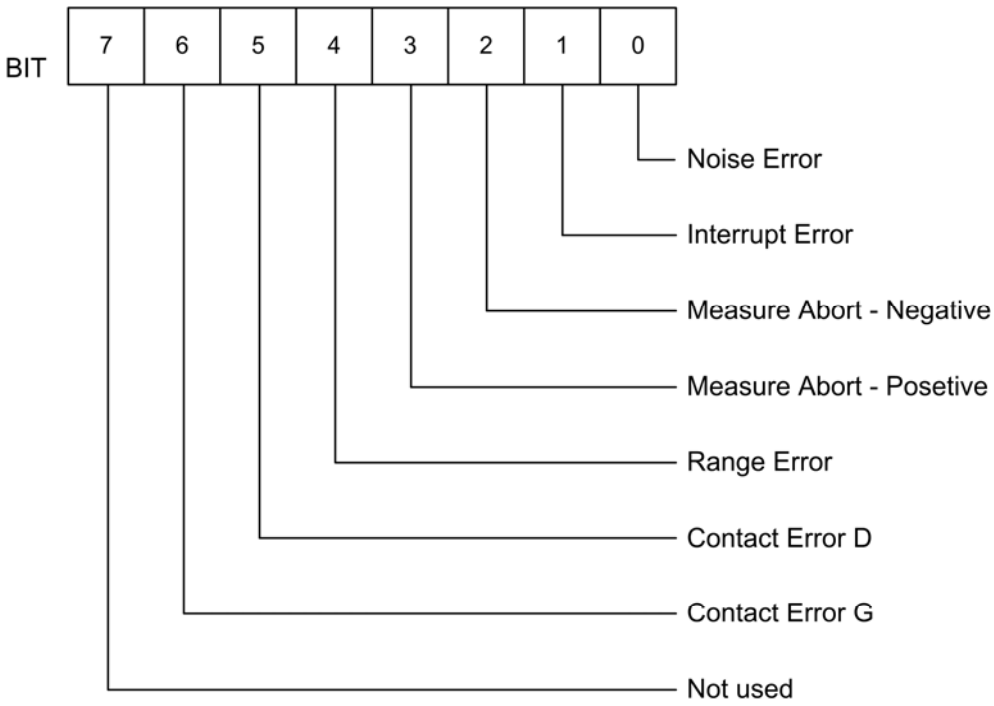


Fig. 22 Measure Error Status Register

Input commands

This section describes the commands used on the DB502 (Not in DB501 mode

DB502 IEEE488-2 command

*TRG	Device trigger
*IDN?	Return device identifier. DANBRIDGE,DB502,AA,XXXXXXXX-YYYYYYYYY XXXXXXXX = Software version, CCPU YYYYYYYYY = Software version, MCPU The AA is a special subversion number, should normally just be ignored .
*CLS	Clear all event registers.
*STB?	Read STATUS BYTE REGISTER (SPOLL).
*SRE	Set SERVICE REQUEST ENABLE REGISTER (mask for SPOLL reg.).
*SRE?	Recall SERVICE REQUEST ENABLE REGISTER setting.
*ESE	Set STANDARD EVENT STATUS ENABLE REGISTER.
*ESE?	Recall STANDARD EVENT STATUS ENABLE REGISTER
*ESR	Read STANDARD EVENT STATUS REGISTER. (*ESR? To be used)
*RST	Total reset. (WAIT. 10 SEC).
*PSC	Clear all enable registers on power on. 0 = No change on power on. 1 = Clear on power on
. *PSC?	Recall *PSC setting

Device dependent input commands

AVERAGE	Set average count (1-100).
AVERAGE?	Recall average count.
CAVERAGE	Set continuous mode average count (1-100).
CAVERAGE?	Recall continuous mode average count (1-100).
ACKCMD	Acknowledge command (Send DONE). 0 = No acknowledgement. 1 = Acknowledge by sending DONE.
ACKCMD?	Recall acknowledge command

RANGE	Set range number, or auto range mode 0 = Auto range 1 = Range 1, 2= Range 2.... 11 = Range 11
RANGE?	Recall range setting. 0 = Auto range 1 – 11: The range number the device is set for FAULT: should never happen under normal operation.
*TRG	Trig device/ Make measurement
CTEST	Contact test select 1 / ON = Contact test ON 0 / OFF = Contact test OFF
CTEST?	Recall Contact test selection
CTLEVEL	Set contact test level (0 - 210)
CTLEVEL?	Recall Contact test level
DATATRANS	Switch data transmission for single measurements on or off (See CNTOUT for continuous) 1 / ON = Data transmission on 0 / OFF = Data transmission off
DATATRANS?	Recall data transmission setting
DEVIATION	Turn deviation mode on or off 1 / ON = Deviation on 0 / OFF = Deviation off
DEVIATION?	Recall deviation setting
DEVTYPE	Set deviation type 0 = Resistance 1 = 100% FS 2 = 10% FS 3 = 10% FS ABS OHM
DEVTYPE?	Recall deviation type
EMULATION	Set emulation ON/OFF 1 / ON = DB501 mode, change back using EM0 which is DB501 style command
EMULATION?	Recall emulation mode setting
HISPEED	Set HISPEED mode on/off 1 / ON = HISPEED on (Note: Overrides TERMCOMP) 0 / OFF = HISPEED off
HISPEED?	Recall HISPEED mode
CONTINUOUS	Continuous measurements (Can be stopped by a single trig)

CNTOUT	Set continuous measurement data out 1 / ON = Cont. data out 0 / OFF = Not cont. data
CNTOUT?	Recall continuous measurement data out
LOCAL	Set DB502 local, return from remote state.
LIMCLEAR	Clear limits 1 = Clear limits
LIMTYPE	Set limit type 0 = Resistance, absolute 1 = Resistance, deviation normal 2 = Deviation, percentage 3 = Deviation, symmetrical
LIMTYPE?	Recall limit type
LIM0, LIM1, LIM2, LIM3, LIM4, LIM5, LIM6, LIM7, LIM8, LIM9, LIMA, LIMB	Set a given value for the corresponding limit. A is limit 10 and B is limit 11
LIM0?, LIM1?, LIM2?, LIM3?, LIM4?, LIM5?, LIM6?, LIM7?,LIM8?, LIM9?, LIMA?, LIMB?	Recall current value for the corresponding limit. A is limit 10 and B is limit 11
LIMIT	Set limit ON/OFF 1 / ON = Limit ON 0 / OFF = Limit OFF
LIMIT?	Recall limit (On/OFF)
MESTB?	Read MEASUREMENT ERROR STATUS REGISTER.
MEER	Set MEASUREMENT ERROR ENABLE STATUS REGISTER.
MEER?	Recall MEASUREMENT ERROR ENABLE STATUS REGISTER setting.
NOISE	Set noise type 0 = Off 1 = Noise ON 0.1% 2 = Noise ON 0.2%
NOISE?	Recall noise type
REJECT	Set reject frequency 50HZ = Set 50HZ reject frequency 60HZ = Set 60HZ reject frequency

REJECT?	Recall reject frequency setting (Returns “REJECT 50HZ” or “REJECT 60HZ” depending on current setting.
NOMVAL	Set nominal value Example: NOMVAL [value] OHM
NOMVAL?	Recall nominal value (returns “NOMVAL [value] OHM”)
ZEROADJ	Perform Zero adjust, or run it off 0 / OFF = turn zero adjust off 1 / ON = Perform zero adjust On returns either “ZEROADJ ENDED” (when ok), or “ZEROADJ ABORTED” (when fault) after finishing the zero adjust.
ZEROADJ?	Recall zero adjust setting. 1 = DB502 is zero adjusted 0 = DB502 is not zero adjusted
TERMCOMP	Select thermo comp. type Off, Fast or Normal (turns on if needed) 0 = Off 1 = Fast 2 = Normal Returns TERMCOMP AVERAGEERR if average is not valid. Note: HISPEED overrides these settings if turned on.
TERMCOMP?	Recall thermo comp. setting
TRIG	Select whatever trig from the limit and control I/O (Rear panel) is active. 1 / ON = External trig input valid 0 / OFF = Block for external trig input
PREFIX	Prefix ON/OFF. Select Prefix or Scientific format for measurement data. 1 / ON = Prefix ON 0 / OFF = Prefix OFF, use scientific format
PREFIX?	Recall prefix setting
@DCL	Device clear

Remote operation DB501 commands (DB501 emulation mode)

Bus Commands for IEEE and RS232 when the device is in DB501 emulation mode.

Default values after Device Clear or RESET
(See Section 2.9.) are marked with *

Deviation			
D Code	D0	Deviation OFF	
	D1	Deviation ON absolute	
	D2	Deviation ON 100% F.S.	
	D3	Deviation ON 10% F.S.	
	D4	Deviation OFF, delete nominal value	*
	D5	Deviation ON 10% F.S. with direct ohm reading	

Error Output			
E Code	E0	Error message SRQ OFF	
	E1	Error message SRQ ON	*
	E2	SRQ after command executed (done) OFF	*
	E3	SRQ after command executed (done) ON	
	E6	SRQ on measurement error OFF	*
	E7	SRQ on measurement error ON	
	E8	Data transmission without SRQ OFF	*
	E9	Data transmission without SRQ ON	

Recall Status			
K Code	KK	Return K-flag (See Section 3.1.1.)	

Zero Adjust			
J Code	J0	Zero Adjust OFF	*
	J1	Create Zero Adjust (delay next command code 2 sec.) After J1, no characters must be sent, i.e. no CR LF	

Limit Code			
L Code	L0	Limit OFF	*
	L1	Limit ON, Normal Display	
	L2	Limit OFF, DELETE Limits	

Measurement Control			
M Code	M0	Perform continuous measurements	
	MD	Disable trig input (no external trig response)	
	ME	Enable trig input (external trig response)	
	MN	Thermo voltage compensation OFF (Normal)	*
	MT	Thermo voltage compensation ON	
	MF	Fast Thermo Voltage Compensation ON	
	MLxxx	Contact Test Level (xxx = 000 to 210)	

Data Output Control			
O Code	O0	Standard output	*
	O1	Standard output without limit info	
	O2	Printer output without limit info	
	O3	Printer output format without limit info	
	O6	Data transmission after trig ON	*
	O7	Data transmission after trig OFF	
For IEEE only	O8	Return K-flag as ASCII characters (4 char.)	
	O9	Return K-flag as hexadecimal (2 char.)	*
	OA	Set "; " before limit info	
	OB	Set "CRLF" before limit info.	

Display Control			
P Code	P0	Normal display	*
	P1	Ignored on DB502 (Only BIN display)	

Recall Reference Value			
R Code	RN		
See TABLE 3 for reference value I/O codes (See also Section 3.1.1)	R0 - B	Return Limit X (X = 0 – 11 in decimal)	

Store Reference Value			
S Code	SN	Store Nominal Value for deviation Mode	*
See TABLE 3 for reference value I/O codes.	P0 - B	Store Limit X (X= 0 – 11 in decimal)	

Single Measurements			
T Code	TR	Perform a single measurement (TRIG). After TR no characters must be sent (i.e. no CR LF)	
	T000	Average on TRIG OFF	*
	TXXX	Average on TRIG ON (XXX = 000 to 1000 average count of measurements)	

Table 3. Reference Value I/O Codes (501 mode)

Table 3. Reference Value I/O Codes		
		String character codes
1. character	Nominal Value (NOM VAL) LIM 0 – B Absolute limits LIM 0 – B Deviation limits LIM 0 – B % limits	R R W P
2. character	Nominal Value Lim 0 – B: Absolute limits SIGN OF VALUE Dev. Limits Channel selection	Space Space + / - *
3. character	Decimal point	.
4.-8. character	Value in 5 digits	
9. character		E
10. character	NOM VAL Sign of exponents LIM 0 – B Sign of exponent	+ -
11.-12. character	NOM VAL Exp. In 2 digits LIM 0 – B Exp. In 2 digits	
13. character 14. character		CR LF

IEEE Remote Programming (501 mode)

The Device dependant messages for DB502 in DB501 mode are listed in TABLE 2.

Some commands require time to execute, (e.g. D2, D3, D4, J1, L1 & SN), and the next command must be delayed accordingly. By sending E3, a Service Request SRQ for Done is sent after each command execution.

Recall Status, Recall Reference Value and Store Reference Value are described in detail in the following

Recall Status (501 mode)

The DB501 mode outputs status information about the actual setup, when receiving the status call KK.

The DB501 mode returns a SRQ and waits for the controller in charge to carry out a SERIAL POLL sequence after which, when addressed to talk, the DB501 mode sends the K-flag.

The K-flag is a 16 bit flag loaded in hexadecimal, in two characters. The flag indicates the current mode of the operation:

K-flag MSB:

K-flag MSB:							
ON (1)							
	Deviation						
OFF (0)							

K-flag LSB:							
ON (1)							
Ω %	10% FS/ 100% FS		Limit mode	DEVLIM ABSLIM.	%-DEV R-DEV.		
OFF (0)							

DEVIATION MODE if ON LIMIT MODE IF ON

NB: When the command O8 is received prior to KK, the flags are sent as ASCII characters, four characters in all.

Recall Reference Value (501 mode)

DB501 mode returns a SRQ and waits for the controller in charge to carry out a SERIAL POLL sequence. The DB501 sends the selected reference value (RN & R0 – RB) when addressed to talk after the SERIAL POLL sequence.

The output format is listed in Reference Value I/O Codes TABLE 3.

Store Reference Values (501 mode)

DB501 mode waits for a 14 character string containing the reference data after receiving the command (SN or S0 – SB). The input format is listed in reference Value I/O Codes TABLE 3.

Service Request Status Byte (501 mode)

DB501 mode sends SRQ when a measurement is completed and output data is available in the TALKER and LISTENER MODE, of if the DB502 receives erroneous input strings

NB: The bus controller has to perform a SERIAL POLL sequence *) in response to the SRQ, in order to remove the DB501 interface from the SRQS State (Service Request State). The DB501 mode will not respond to any bus-commands before the SERIAL POLL sequence is performed, which is in accordance with the IEEE Standard.

Status byte (Sent out during SERIAL POLL)

	SRQ ON						ERROR	FUNCTION
0	1	0	0	0	0	0	0	Data Ready
0	1	0	0	0	0	0	1	Syntax error in input string
0	1	0	0	0	0	1	1	RN, D1, D2 or D3 received without a stored reference value
0	1	0	0	0	1	0	0	Command done
0	1	0	0	0	1	0	1	R0 – RB or L1 received without a stored reference value
0	1	0	0	0	1	1	1	L1 received with stored deviation limits, but without a NOM VAL:
0	1	0	0	1	0	0	1	Abort of received D5 because of active deviation limits.
0	1	0	0	1	1	1	1	Non Digit character in value string
0	1	0	1	1	0	0	1	Jig Zero not possible

*) See Section 6.5.2, Page 65 in “IEEE Standard Digital Interface for Programmable Instrumentation ANSI/IEEE Std. 488-1978”.

RS232 Remote Programming (501 mode)

The RS232 interface has a transmission format of V24 asynchronous data in half duplex at 7 different BAUD rates from 300 BAUD to 19200 BAUD.

Data Input format

The data input format is equal to the IEEE input format, except for the control commands which all begin with an asterisk (See Section 3.1 for details)

WARNING: The reset command *C restarts the DB501 with ALL PREVIOUSLY STORED DATA DELETED!

Data Transfer Control

Set SC3 pin 20 (DTR) HIGH (e.g. connect pin 20 to pin 5 or 6, which are both connected by 3.16k to +12v). The interface signal Printer Busy, Low (from -3 to -12V), the SC3 pin20 will cause the transmission in progress to stop.

The transmission will continue as soon as DTR returns to HIGH (+3 to +12V)

The DTR pin may be left unconnected if a “BUSY” signal to stop transmission is not required.

Data Output Format

4 characters in a continuous string terminated by CR LF for KK.
(See table 1&3 for measurement data and reference value output)

Fault or Status Indication

DB502 in DB501 returns 2 characters terminated by CR LF:

*A	Syntax error in input string.
*C	RN, D1, D2, or D3 received without a stored reference value
*D	Command done
*E	R0 – Rb or L1 received without a stored reference value.
*G	L1 received with stored deviation limits, but without NOM VAL
*I	Abort of received D5 because of active deviation limits.
*O	Non Digit character in value string
*Y	Jig Zero possible

PC Setup (501 mode)

Set-up examples

A: Deviation measurements 10% FS: NOM VAL = 1.0000 kΩ with the following limits: -10%, -2%, +2%, +10%

STEP	COMMAND	INPUT STRING	NOTES
1	L2		Limit OFF, delete limits
2	D4		Deviation OFF – NOM VAL
3	SN	R .21500E+05 CR LF	NOM VAL stored
4	D2		Deviation ON 100% FS
5	S0	P*.100000E+01 CR LF	LIM 0 stored
6	S1	P*.200000E+01 CR LF	LIM 1 stored
7	S2	P*.100000E+02 CR LF	LIM 2 stored
8	L1		Limit ON
9	T0	10	Average of 10 on Trig

B: Example A is already working, but an extra high limit is needed:

STEP	COMMAND	INPUT STRING	NOTES
1	S5	P+.25000E+02 CR LF	LIM 5 stored
2	L1		LIM 5 ON

I.e.: It is always possible to add limits

C: Deviation measurements 100% FS: NOM VAL 21.500 kΩ with an average on trig equal to 10 and the following Channel Limits: 1%, 2%, 10%::

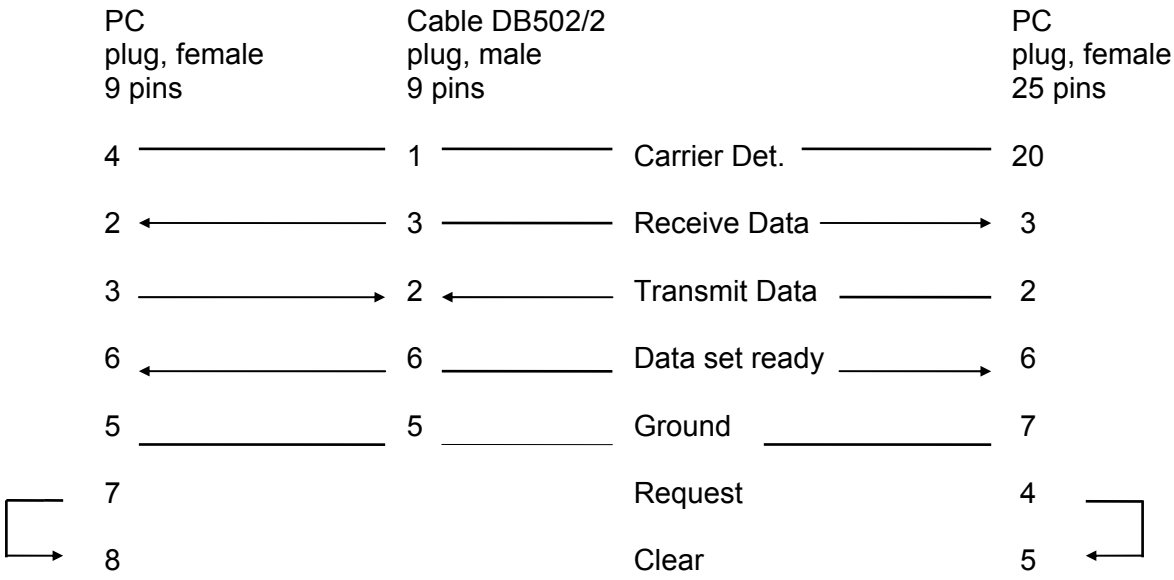
STEP	COMMAND	INPUT STRING	NOTES
1	L2		Limit OFF, delete limits
2	D4		Deviation OFF – NOM VAL
3	SN	R .21500E+05 CR LF	NOM VAL stored
4	D2		Deviation ON 100% FS
5	S0	P*.100000E+01 CR LF	LIM 0 stored
6	S1	P*.200000E+01 CR LF	LIM 1 stored
7	S2	P*.100000E+02 CR LF	LIM 2 stored
8	L1		Limit ON
9	T0	10	Average of 10 on Trig

Omit step 1 and 2 if the DB502 (DB501 mode) has just been reset or no nominal value and limits have been stored since last reset.

D: Direct OHM measurements with the following absolute limits; 2kΩ, 3kΩ, 4kΩ, 5kΩ:

STEP	COMMAND	INPUT STRING	NOTES
1	L2		Limit OFF, delete limits
2	D4		Deviation OFF – NOM VAL
3	S0	R .20000E+04 CR LF	LIM 0 stored
4	S1	R .30000E+04 CR LF	LIM 1 stored
5	S2	R .40000E+04 CR LF	LIM 2 stored
6	S3	R .50000E+04 CR LF	LIM 3 stored

RS232 Cable Connections



Appendix A – Standard Limit Sets, E24, E48 and E96

DB502 has three predefined limit sets for sorting resistors in groups according to the three standard series E24, E48 and E96

The limits are called from the LIMITSET SETUP menu.

The following table shows the values of these predefined limit sets:

	E24		E48		E96	
	Deviation on 100% FS		**Deviation on 10% FS**		**Deviation on 10% FS**	
LIM0	-41.899%		-22.899%		-12.189%	
		62 Ω		787 Ω		887 Ω
LIM1	-35.277%		-19.110%		-10.057%	
		68 Ω		825 Ω		909 Ω
LIM2	-28.760%		-15.136%		-7.874%	
		75 Ω		866 Ω		931 Ω
LIM3	-21.587%		-10.965%		-5.637%	
		82 Ω		909 Ω		953 Ω
LIM4	-13.691%		-6.590%		-3.346%	
		91 Ω		953 Ω		976 Ω
LIM5	-5.000%		-2.000%		-1.000%	
		100 Ω		1000 Ω		1000 Ω
LIM6	5.000%		2.000%		1.000%	
		110 Ω		1050 Ω		1020 Ω
LIM7	15.573%		7.012%		3.452%	
		120 Ω		1100 Ω		1050 Ω
LIM8	27.210%		12.271%		5.963%	
		130 Ω		1150 Ω		1070 Ω
LIM9	40.020%		17.788%		8.535%	
		150 Ω		1210 Ω		1100 Ω
LIM10	54.119%		23.576%		11.170%	
		160 Ω		1270 Ω		1130 Ω
LIM11	69.638%		29.648%		13.869%	

Appendix B – Range selection

Resistance Ranges

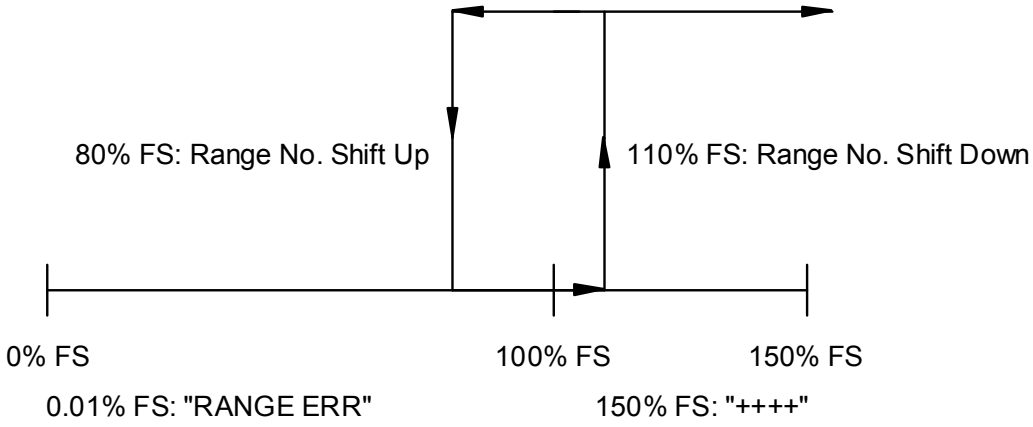
In resistance mode the best accuracy is achieved at the highest value in each range. Maximum usable dynamic range for each resistance range is ~ 0.01% to 150%, but accuracy is only guaranteed in the specified intervals.

Range No.	Rx,min	Rx, max	Uncert. (%)	Test Current (I_X)
1	10.001 Mohm	100.000 Mohm	0.2 %	111nA
2	1.001 Mohm	10.000 Mohm	0.05 %	1.11uA
3	100.001 kohm	1.000 Mohm	0.05 %	11.1uA
4	10.001 kohm	100.000 kohm	0.05 %	111uA
5	1.001 kohm	10.000 kohm	0.05 %	333uA
6	100.001 ohm	1.000 kohm	0.05 %	1.11mA
7	10.001 ohm	100.000 ohm	0.05 %	3.33mA
8	1.001 ohm	10.000 ohm	0.05 % [1)]	11.1mA
9	100.001 mohm	1.000 ohm	0.1 % [1)]	33.3mA
10	10.001 mohm	100.000 mohm	2 % (0.2 mohm) [1)]	111mA
11	1.001 mohm	10.000 mohm	20 % (0.2 mohm) [1)]	111mA

1): Thermo Voltage Compensation (TVC) Normal On.

Auto Range

Only applies to resistance mode and continuous measurement.



10% Deviation Mode Ranges

In deviation mode the best accuracy is achieved at the lowest value in each range. Maximum usable dynamic range of deviation for each resistance range is -50% to +50%, but accuracy is only guaranteed within -20% to +20%.

Range No.	Rnom,min	Rnom, max	Uncert. (%)	Test Voltage (U_X) [2]
1	100.000 Mohm	1.0000 Gohm	0.5 %	33.3V
2	10.000 Mohm	99.999 Mohm	0.1 %	33.3V
3	1.000 Mohm	9.9999 Mohm	0.01 %	33.3V
4	100.000 kohm	999.99 kohm	0.01 %	33.3V
5	10.000 kohm	99.999 kohm	0.01 %	10.0V
6	1.000 kohm	9.9999 kohm	0.01 %	3.33V
7	100.000 ohm	999.99 ohm	0.01 %	1.00V
8	10.000 ohm	99.999 ohm	0.01 % [1]	333mV
9	1.000 ohm	9.9999 ohm	0.01 % [1]	100mV
10	100.000 mohm	999.99 mohm	0.05 % [1]	33.3mV
11	10.000 mohm	99.999 mohm	0.3 % (0.03 mohm) [1]	3.33mV

1): Thermo Voltage Compensation (TVC) Normal On.
2): For $R_X = R_{nom}$ (Dev = 0%).

100% Deviation Mode Ranges

In deviation mode the best accuracy is achieved at the lowest value in each range. Maximum usable dynamic range of deviation for each resistance range is -100% to +150%, but accuracy is only guaranteed within -(100% - 0.01% - uncert.(%))% to +130%.

Range No.	Rnom,min	Rnom, max	Uncert. (%)	Test Voltage (U_X) [2]
1	100.000 Mohm	1.0000 Gohm	0.5 %	11.1V
2	10.000 Mohm	99.999 Mohm	0.5 %	11.1V
3	1.000 Mohm	9.9999 Mohm	0.2 %	11.1V
4	100.000 kohm	999.99 kohm	0.05 %	11.1V
5	10.000 kohm	99.999 kohm	0.05 %	3.33V
6	1.000 kohm	9.9999 kohm	0.05 %	1.11V
7	100.000 ohm	999.99 ohm	0.05 %	333mV
8	10.000 ohm	99.999 ohm	0.05 % [1]	111mV
9	1.000 ohm	9.9999 ohm	0.1 % [1]	33.3mV
10	100.000 mohm	999.99 mohm	0.2 % (0.2 mohm) [1]	11.1mV
11	10.000 mohm	99.999 mohm	2 % (0.2 mohm) [1]	1.11mV

1): Thermo Voltage Compensation (TVC) Normal On.
2): For $R_X = R_{nom}$ (Dev = 0%).

Appendix C – Porting RS232/IEEE488 from DB501 to DB502

The DB502 mode uses a different command set than the DB501. The following contains DB501 commands and some commands or explanation on how to use equivalent DB502 commands. Please note that some options are only available in DB502 mode, while some DB501 options have been found irrelevant on the DB502.

DB501 Command:	C0 – Continuous data our OFF (Not available on original DB501)
DB502 Handling:	CNTOUT OFF / CNTOUT 0 Returns DONE if requested

DB501 Command:	C1 – Continuous data our ON (Not available on original DB501)
DB502 Handling:	CNTOUT ON / CNTOUT 1 Returns DONE if requested

DB501 Command:	C? – Continuous data our setting out (Not available on original DB501), returns C1 when ON and C0 when off
DB502 Handling:	CNTOUT? Returns CNTOUT 0 when off, CNTOUT 1 when on

DB501 Command:	D0 – Deviation OFF
DB502 Handling:	DEVIATION OFF Returns DONE if requested

DB501 Command:	D1 – Deviation ON absolute
DB502 Handling:	DEVTYPE 0 DEVIATION ON Returns DONE if requested in both cases

DB501 Command:	D2 – Deviation ON 100% F.S.
DB502 Handling:	DEVTYPE 1 DEVIATION ON Returns DONE if requested in both cases

DB501 Command:	D3 – Deviation ON 10% F.S.
DB502 Handling:	DEVTYPE 2 DEVIATION ON Returns DONE if requested in both cases

DB501 Command:	D4 – Deviation OFF, Delete nominal value
DB502 Handling:	DEVIATION OF Returns DONE if requested No exact equivalent in DB502 mode, the difference is that the delete of the nominal is ignored (Serves no functional purpose).

DB501 Command:	D5 – Deviation on 10% F.S. with direct ohm reading
DB502 Handling:	DEVTYPE 3 DEVIATION ON Returns DONE if requested in both cases

DB501 Command:	E0, E1, E2, E3, E6, E7, E8, E9, KK – Error signalling and SRQ handling settings etc.
DB502 Handling:	These are not available in DB502 mode as it is handled using IEEE488.2 standard. In general measurement errors can be read via in the result, and also using the appropriate internal registers according to IEEE488.2. See MEER/MESTB commands. . Errors codes are being send in text form, and the same goes for the DONE message.. When using IEEE488 in this mode, a result or error code can be read as a normal string with an SRQ signal.

DB501 Command:	J0 – Zero Adjust OFF.
DB502 Handling:	ZEROADJ OFF Returns DONE if requested

DB501 Command:	J1 – Create Zero Adjust
DB502 Handling:	ZEROADJ 1 On returns either “ZEROADJ ENDED” (when ok), or “ZEROADJ ABORTED” (when fault) after finishing the zero adjust. Beware that the DB502 can have some variations in the time it takes depending on the conditions and state of the device..

DB501 Command:	L0 – Limit OFF
DB502 Handling:	LIMIT OFF Returns DONE if requested.

DB501 Command:	L1 – Limit ON, normal display
DB502 Handling:	LIMIT ON Returns DONE if requested.

DB501 Command:	L2 – Limit OFF, Delete Limits
DB502 Handling:	LIMCLEAR 1 Returns DONE if requested.

DB501 Command:	M0 – Perform continuous
DB502 Handling:	CONTINUOUS Note that the DB502 (Also in DB501 mode) has the option to send measurement data even in continuous mode. No done is send, but measurements if data out in continuous mode is selected.

DB501 Command:	MD – Disable TRIG INPUT (from rear panel)
DB502 Handling:	TRIG OFF Returns DONE if requested.

DB501 Command:	ME – Enable TRIG INPUT (from rear panel)
DB502 Handling:	TRIG ON Returns DONE if requested.

DB501 Command:	MN – Measurement Normal (Thermo voltage compensation OFF)
DB502 Handling:	TERMCOMP 0 Returns DONE if requested.

DB501 Command:	MT – Measurement Thermo voltage compensation ON
DB502 Handling:	TERMCOMP 2 Returns DONE if requested.

DB501 Command:	MF – Fast Thermo Voltage Compensation ON
DB502 Handling:	TERMCOMP 1 Returns DONE if requested.

DB501 Command:	MLxxx – Contact Test Level
DB502 Handling:	CTLEVEL xxx, to set contact test level CTEST ON or OFF to turn on or off. Each returns DONE if requested.

DB501 Command:	M5 – Set 50Hz reject frequency
DB502 Handling:	REJECT 50HZ Returns DONE if requested.

DB501 Command:	M6 – Set 60Hz reject frequency
DB502 Handling:	REJECT 60HZ Returns DONE if requested.

DB501 Command:	N0 – Noise compensation OFF (Not available on original DB501)
DB502 Handling:	NOISE 0 Returns DONE if requested.

DB501 Command:	N1 – Noise compensation 0.1% by 1% (Not available on original DB501)
DB502 Handling:	NOISE 1 Returns DONE if requested.

DB501 Command:	N2 – Noise compensation 0.2% by 1% (Not available on original DB501)
DB502 Handling:	NOISE 2 Returns DONE if requested.

DB501 Command:	O0, O1, O2, O3 – Data transmission format selection
DB502 Handling:	Not directly available in DB501, no printer format available. However prefix or scientific can be selected using the PREFIX command. PREFIX OFF : Use scientific data format PREFIX ON: Use prefix data format Returns DONE if requested.

DB501 Command:	O6 – Data transmission after TRIG ON
DB502 Handling:	DATATRANS ON Returns DONE if requested. Note that a similar command exist for continuous mode: CNTOUT ON

DB501 Command:	O7 – Data transmission after TRIG OFF
DB502 Handling:	DATATRANS OFF Returns DONE if requested. Note that a similar command exist for continuous mode: CNTOUT OFF

DB501 Command:	O8, O9, OA, O9 – K flag control and semicolon control
DB502 Handling:	The flag is not available in DB502 mode. Use respected request commands for getting the same information. For example DEVIATION? Etc. depending on the needed information.

DB501 Command:	P0, P1 – Normal display / Only BIN display (No operation code on DB502)
DB502 Handling:	There is no such command in DB502, in DB501 mode the device will accept the command in order to keep compliance with the original DB501.

DB501 Command:	RN – Return nominal value
DB502 Handling:	NOMVAL?

DB501 Command:	R0-B – Return Limit X
DB502 Handling:	LIM0-B? For example LIM0? Returns the value of limit 0

DB501 Command:	SN – Store nominal value
DB502 Handling:	NOMVAL [value] For example NOMVAL 100K Returns DONE if requested.

DB501 Command:	S0-B – Store limit value
DB502 Handling:	LIM0-B [value] For example LIM0 10mOHM Returns DONE if requested.

DB501 Command:	TR, *T – Trig, perform a measurement
DB502 Handling:	*TRG

DB501 Command:	T000, Txxx – Set average count or disable average
DB502 Handling:	AVERAGE 1 is same as T000, AVERAGE 2 = T002 etc. Returns DONE if requested.

DB501 Command:	*C, Device clear
DB502 Handling:	*CLS

DB501 Command:	*L, Go to local mode
DB502 Handling:	LOCAL

DB501 Command:	*R, Go to remote mode
DB502 Handling:	Not such command exist in DB502 mode. The remote stat is achieved by the first know command send to the device. For example REJECT? Will return the reject frequency and set the device into remote state at the same time.

DB501 Command:	*M, Perform continuous measurements
DB502 Handling:	CONTINUOUS

Appendix D - Analog Output

The analog output voltage equals the detector voltage buffered with an amplifier with an output swing of ± 10V and an output impedance of 100 ohm ± 1%. The minimum load impedance is 2kohm, but from thermal considerations a load impedance > 10kohm is to be preferred. The analog output connector is a BNC coax with its shield connected to chassis ground. The scaling is as follows:

Resistance Mode:

$$U_{Out} = \left(\frac{20V}{3}\right) \cdot \left(\frac{R_x}{R_{Max}}\right) \approx 6.667V \cdot \left(\frac{R_x}{R_{Max}}\right)$$

where R_{Max} is the maximum resistance of the range in question.

10% Deviation Mode

$$Dev = \left(\frac{1}{20V}\right) \cdot U_{Out} \quad or \quad Dev(\%) = \left(\frac{100}{20V}\right) \cdot U_{Out}$$

$$U_{Out} = 20V \cdot Dev \quad or \quad U_{Out} = \left(\frac{20V}{100}\right) \cdot Dev(\%)$$

+10% deviation corresponds to an analog output voltage of 2V.

100% Deviation Mode

$$Dev = \left(\frac{3}{20V}\right) \cdot U_{Out} \quad or \quad Dev(\%) = \left(\frac{300}{20V}\right) \cdot U_{Out}$$

$$U_{Out} = \left(\frac{20V}{3}\right) \cdot Dev \quad or \quad U_{Out} = \left(\frac{20V}{300}\right) \cdot Dev(\%)$$

+100% deviation corresponds to an analog output voltage of 6.667V.

Appendix E - Specifications

DB502 High Speed DC Resistance Bridge Specifications

For high speed and very accurate automatic production testing and sorting

Mode A:
(Deviation from Nominal Value)

Resistance Range and Nominal Value:
Inserted from the keyboard or by remote control.

Norminal Value Range:
1mΩ – 1,0999GΩ

Deviation Range:
± 10% reading to 19,999%
± 100,00%

TEST VOLTAGE

Resistance Ranges				Deviation 10% Range	Deviation 100% Range
0	-	99.999	mΩ	0-30mV	0-11mV
0,1Ω	-	.99999	Ω	33mV	11mV
1Ω	-	9.9999	Ω	100mV	33mV
10Ω	-	99.999	Ω	130mV	110mV
100Ω	-	.99999	kΩ	1V	330mV
1kΩ	-	9.9999	kΩ	3.3V	1.1V
10kΩ	-	99.999	kΩ	10V	3.3V
100kΩ	-	110	MΩ	33V	11V

MODE B:
(Direct display of Resistance Value)

Resistance Range:
0 Ω to 200 MΩ direct reading in 10 decade ranges set by auto ranging.

Resolution:
5 digits.

Options:
Jig500 4-terminal jig with 0,3m leads and adjustable fixtures for axial radial leads
63523 4-terminal SMD fixture for Jig500
25089 set of 4-terminal Kelvin klips

Test Current

Resistance Ranges				Direct Ω Reading Constant current	
0	-	99.999	mΩ	110	mA
0,1Ω	-	.99999	Ω	33	mA
1Ω	-	9.9999	Ω	11	mA
10Ω	-	99.999	Ω	3.3	mA
100Ω	-	.99999	kΩ	1.1	mA
1kΩ	-	9.9999	kΩ	330	µA
10kΩ	-	99.999	kΩ	110	µA
100kΩ	-	.99999	MΩ	11	µA
1MΩ	-	9.9999	MΩ	1.1	µA
10MΩ	-	200	MΩ	110	µA

MODE A & B.

Measuring speed:
Continuous: 3 measurements per second Trig mode; In the range 1Ω - 10MΩ better than 10 msec, and better that 50 msec in the range 0-0,1 Ω, including display and limit outputs.
Special 50/60Hz hum rejection mode 25msec.

Limits:
12 limits are provided with display indication and output signals for LOW, BIN number and HIGH. Channel limits can be selected

Interface (rear panel):
IEEE488 with "talker only" and "talker/listener" modes. True sub-set of standard –protocol. RS232C with Baud rate up to 19200 Baud. Full two-way control/output. Limit output: open collectors with common protection rell, programmable bin/channel output and common reject pin. Control I/O: TRIG (contact closure or opto-coupler)

MEASURE Signal
TRIG READY Signal
DATA READY Signal
FAULT Signal (out of range signal)

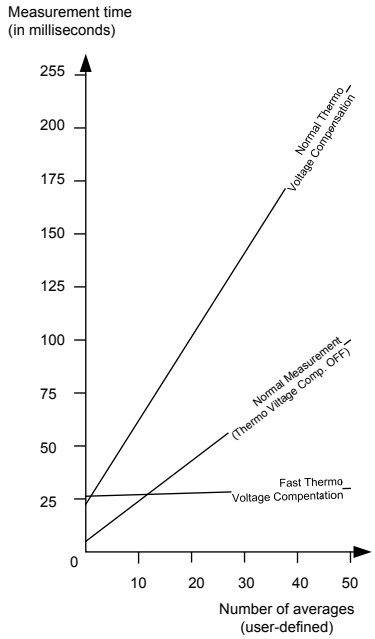
Ambient Temperature:
10° - 40° C.

Power:
90-130 and 200-206 V AC, 50-60Hz

Dimensions:
Height 1400mm/5,8 inch.
Width: 438mm/17,2 Inch.
Dept: 360mm/14,2 Inch.

Weight:
10 kg/22lbs

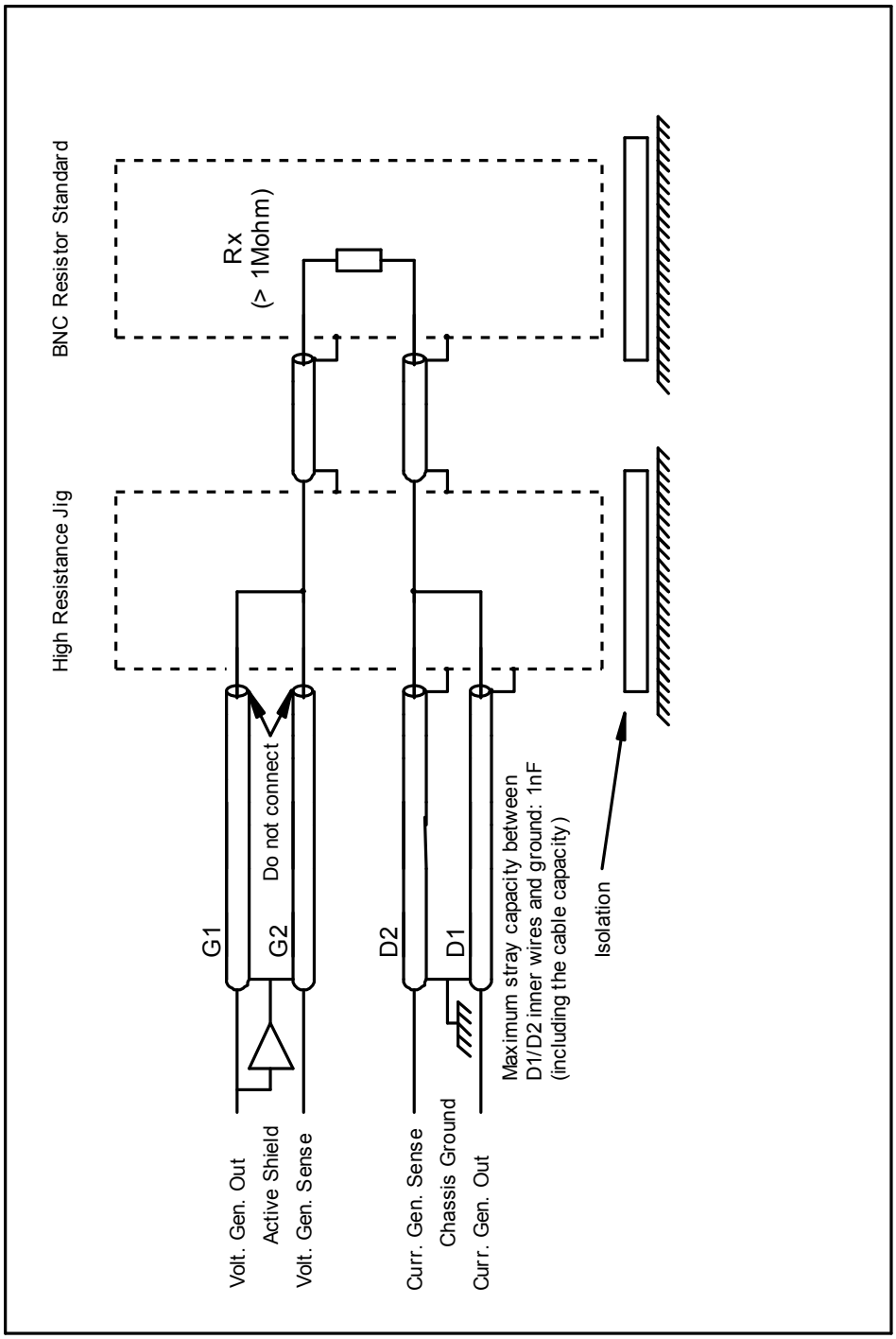
Accessories Supplied:
Line power connector
Four 1,5m coax cables with BNC connectors.
Two output connectors.
Brackets for 19" rack mounting.



Accuracy				Long Term Accuracy		
Resistance Range	Deviation		Direct Ohm Reading	Deviation 10% Full Scale		Direct ohm, 100% F.S. & Resist Dev.
	10% Full Scale	100% F.S & Resist. Dev.		1 Year	3 Years	3 Years
0 – 99,99mΩ	0,1mΩ	0,2mΩ	0,2mΩ	0,1mΩ	0,2mΩ	1 mΩ
0,1Ω – 0,99999 Ω	0,1 %	0,2 %	0,2 %	0,1 %	0,1 %	0,2 %
1 Ω – 9,9999 Ω	0,05%	0,1 %	0,1 %	0,05%	0,05%	0,1%
10 Ω – 9,9999MΩ	0,01%	0,05%	0,1 %	0,01%	0,02 %	0,1 %
10 MΩ – 199,99MΩ	0,1%	0,2 %	0,2 %	0,1 %	0,1 %	0,2 %
200MΩ – 1,1GΩ	0,5%	0,5 %		0,5%	0,5 %	0,5 %[1] (1 in Dev.only)
0 – 19,999mΩ	30µΩ*	0,1mΩ*	0,1mΩ*	0,1mΩ*	0,2mΩ*	0,5mΩ*
20mΩ – 99,999mΩ	0,3%*	1%*	1%*	0,1mΩ*	0,2mΩ*	0,5mΩ*
Temperature Range	15°C - 35°C			25°C ± 2°C		15°C - 35°C

*) in fast thermo voltage compensation mode, average ≥20

Appendix F - High Resistance Jig



Alfabethical Index