Model 4025D
Frequency Selective Multimeter
Operating Manual

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1. Instrument overview

1.1 Description

The Model 4025D Tunable Multimeter is a frequency selective ammeter and voltmeter used to measure the magnitude and phase angles of signals produced by the Model 4024/4024B Injection Units. The voltmeter part of the 4025D allows touch and step voltages to be measured easily and accurately, which is important for the safety of both the general public and utility personnel.

It caters for rejection of 50 Hz or 60 Hz power frequencies. The high quality of the Multimeter's filters allows it to be used at frequencies up to a limit of 1Hz from the power frequency and still reject power frequency interference. The Model 4025D is designed for portable use in the field; powered via an internal rechargeable battery.

1.1.1 Current Inputs

The current inputs are specifically for use with:
- a (Rogowski) Type 545 worm coil, or
- a LEM~flex RR3020 AC current probe

The Rogowski coil and LEM current probe are available as optional accessories. These accessories are very convenient current measuring devices, which can simply be wrapped around current carrying structures. The ability to measure currents in various structures is important in tracking earth currents during investigations. Utility engineers need an accurate picture of the earth currents flowing in substations, power stations and similar large installations when designing protection systems.

1.1.2 Impedance and Phase Angle measurements

Simultaneous measurement of voltage and current (Rogowski coil or Lem) are made.

The voltage input is always used as the reference input for the purpose of calculating the phase angle and impedance.

Phase angle and impedance calculations are also displayed.

The impedance value is displayed just below the phase angle result, in smaller text.

1.1.3 Frequency Range

The Multimeter operates in the following frequency range:
- 40 - 69 Hz range

The rejection power/mains frequency is factory configured to either 50 or 60Hz.

1.2 Multifunction LCD and Keypad

The backlight LCD shows:
- all measurements in large easy to read digits, and
- All instrument settings.

The full alphanumeric keypad enables the user to enter various test parameters settings and record information such as the serial number of a device test. Alphabet and numeric characters may be entered, where applicable.

1.3 Test Records via USB interface

Up to 7000 measurements, or test records, may be stored in the instrument's internal memory.

The common tests, such as ground impedance, step voltage, touch voltage, or surface potential distribution, require the tester to enter or record additional information. This additional information is also saved in the test records. Each record is also time-stamped with date and time of the actual measurement.

The test records may be downloaded to a PC via the USB interface.

2. Operating Instructions

The 4025D is essentially a multimeter that measures voltages and currents at a particular frequency set by the user. The selected frequency is also referred to as the *tuned frequency* in this document.

2.1 Safety Warning about Input Connections to 4025D

1. The voltage and current measurement circuits of the 4025D instrument is **NOT** electrically isolated from any metal parts on the front panel.

2. When measuring a voltage that is referenced to earth, always connect the EARTH connection wire to the BLACK input terminal. This will ensure the rest of the exposed metal parts on the front panel of the instrument (Rogowski outer metal sleeve, BNC outer connection and USB shield) are as close to earth potential as possible when the voltage signal is connected. Failure to do so may expose those metals parts to the high voltage source. An example of the recommended connection is shown in the diagram below (Figure 1).

3. Always check and confirm the insulation on the Rogowski coil or LEM coil is in good condition prior to use.

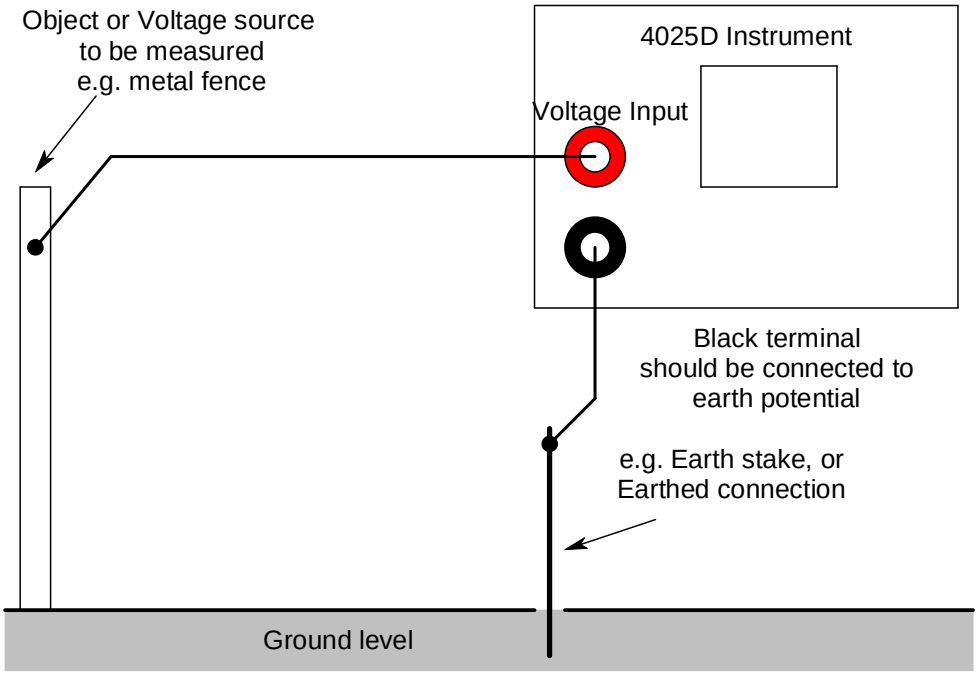


Figure 1. Recommended voltage input connection.

2.2 Isolated Voltage Input

From approximately end of July 2009 onwards, the voltage input was revised specifically to be isolated from the rest of the instrument.

Instruments manufactured since that time had serial numbers 6145 onwards.

The isolation voltage rating is listed in the specification section.

Safety Note:

Please note current measurement circuits of the 4025D instrument (Lem and Rogowski coil input) remain NOT electrically isolated from any metal parts on the front panel. The safety warnings described in the previous section should still be followed as a precaution.

2.3 Input Connections

2.3.1 Voltage Input

The voltage input connection is made via two 4mm binding post terminals on the front panel. Please also refer to the **safety warning** about the input connections.

2.3.2 Voltage Input Impedance

Refer to the description of the "I/P Z" Button in the DMM mode section.

2.3.3 Rogowski Coil / Type 545 worm Current Input

The coil connection is made via a 3-pin LEMO socket on the front panel.
Please also refer to the **safety warning** about the input connections.

2.3.4 LEM~flex Current Input / Coil Module input

The LEM~flex module 4mm safety plugs connect directly to the LEM input terminals without any additional cables required. This input is also known as the coil module input.
Please also refer to the **safety warning** about the input connections.

2.4 Nominal Measurement Ranges

Nominal ranges are:

Voltage: 20mV, 0.2V, 2V, 20V, 200V

Rogowski: 0.2A, 2A, 20A, 200A

LEM / Coil module: 3000mV (full-scale output from LEM or coil module).

(Current range on LEM RR3020 / coil module:
30A / 300A / 3000A select via slide switch).

2.4.1 Actual Range limits

In order to facilitate rejection of very high level of mains frequency noise, sufficient input signal magnitude headroom has been designed into each of the ranges.

If the ambient noise level due to the mains supply and other noise sources are low or zero, the actual input limit is approximately twice the level of the nominal full scale range. For

example, on the 2V range, it is possible to measure a signal up to 4V, provide the noise level is very low. The only exception is the 200V range which has an absolute limit of 240V.

If the input exceeds its nominal limit, this condition is indicated by an "—OR—" in large digits.

2.4.2 Overload Conditions

Overload is indicated on the LCD when the input circuit is overloaded with excessively high signal levels and/or noise.

An overload condition is indicated by the characters "—OL—" in large digits. Please note that the phase angle and impedance result may be affected if any of the inputs measured is overloaded.

A partially overload condition is indicated by a small reversed 'c' character next to the measured reading. This indicates some of the sample points along the signal waveform have exceeded the input range of the internal ADC chip. Avoid this condition where possible.

2.4.3 Measurement at the mains supply frequency (50 or 60Hz)

If the tuned frequency is set to the mains supply frequency, the user will be able to get an indication of the magnitude of the mains supply noise (or signal) present in the circuit under test.

The 4025D with firmware *version 1.23* onwards is now able to measure accurately the signals at the mains supply frequency (50 or 60Hz).

Notes applicable to firmware *prior* to version 1.23:

1. The measurement shown is the attenuated signal of the mains supply frequency. It has been filtered or attenuated sharply in order to improve the measurement accuracy at other frequencies. Typical attenuation of the mains supply frequency is shown in the specification table under parameter "50Hz or 60Hz Noise overload level".

2. Phase angle measurement results are likely to be invalid at the mains supply frequency, again due to filtering of all signals at that particular frequency.

2.5 BNC Output

The BNC output provides a conditioned signal of the current sensed by the Rogowski coil. The output has been magnitude and phase compensated to represent as closely as possible, to the actual current sensed by the Rogowski signal.

Refer also refer to the description of the "BNC" Button in the DMM mode section, as well as the specification for this output. These details are not repeated here.

2.6 Keypad Modes

Due to the need to cater for a wide range of features, the user may be daunted seeing a large number of keys on the front panel. However, the various keys have been arranged logically to operate and react to user input according to which keypad mode the user has selected. Each and every key press is acknowledged by a quiet and short buzzer beep, regardless of keypad mode.

The keypad has 3 modes of operation:

- **DMM** mode: Digital multimeter settings mode.
- **123** mode: Numeric input mode.
- **ABC** mode: Alphabet input mode.

The keypad mode is indicated on the LCD on the bottom line, via 3 characters (DMM, ABC or 123) slightly to the right of the “lcd twirler”.

Each key on the front panel may react in one of three ways, depending on the keypad mode. On the front panel, most keys have 3 labels:

- Labels shown in orange colour are applicable to ABC mode.
- Labels shown in blue colour are applicable to 123 numeric mode, including the arrow keys.
- Labels shown in black colour are applicable to DMM mode.

Regardless of which keypad mode is set; the instrument will always be actively taking measurements. The only exceptions are:

- during times when instrument is downloading data to a PC via the USB interface, or
- during times when HOLD state is asserted

2.6.1 Keys Common to all keypad modes

The keys documented in the table below behave the same way in all keypad modes.

Table 1. Keys common across all keypad modes.

Key Label	Key function in all keypad modes
RESET	To reset the instrument to initial power up status.
OFF	Switch off the instrument. *Note*: The instrument will switch off automatically if left unattended for period of time during which no keys are pressed.
ON	Switch the instrument on.
ABC 123 DMM	Toggles the keypad mode, in the following sequence: DMM → ABC → 123 → DMM

2.6.2 DMM mode

This mode should be used to adjust the various multimeter settings.

In this keypad mode, the various multimeter settings of the instrument may be altered directly and conveniently by the user to suit the input conditions.

The following table describes the various keys available for DMM mode, and what each key does:

Table 2. Functions of each key in DMM mode.

Key Label	Key function in DMM mode
BKLT	Backlight key. Toggles backlight on or off. The LCD backlight consumes approximately one third of the total current consumption. Operating the instrument without the backlight will increase the operating time before a recharge of the internal battery is required.

Key Label	Key function in DMM mode
HOLD	Hold Measurement key. Toggles the hold status for all input measurements. Useful for when users wish to pause the measurement. A reversed "H" is used to indicate hold condition is active.
SAVE	To save the basic measurements shown, including the time of test, as a test record to internal memory when in this mode. (Note: Other test settings, such as test type, x and y coordinates, etc… are not saved. Only default test settings are saved, generally zero or non-applicable settings. These other test settings can only be saved from the menu tests available.)
RANGE UP	To change to the next *higher* range for the *selected input*. The range of the input is shown to the right of the measured value on the LCD.
RANGE DOWN	To change to the next *lower* range for the *selected input*. *Note:* The Lem input has only 1 range of 3V fullscale, corresponding to the Lem unit. However, the measured reading can be scaled to show the correct scaled current to match the setting on the Lem unit ie. 30A, 300A and 3000A, by changing the Lem's range to 30A, 300A and 3000A respectively, instead of leaving it on the 3V range.
INPUT	To select a different input. The instrument will power up with the voltage input selected. The voltage input is referred to as the reference or primary input. The Rogowski and Lem inputs are referred as the secondary input. Pressing the INPUT button will select a different input in the following sequence: Voltage → Rogowski → Voltage → Lem → Voltage → Rogowski, and so on. *Note:* Selecting the Rogowski or Lem input will also change the secondary input measured to Rogowski or Lem respectively. "ROG" or "LEM" characters beside the measured value will indicate which input is measured.
DIS/ENA	To disable or enable the input selected. *Note:* The voltage input cannot be disabled, as it is used as the reference input, for phase and impedance calculations.
AUTO/ MANUAL	Toggles Auto or manual range mode for the selected input.
FREQ UP	To increment the tuned frequency by 1 Hz. The tuned frequency is shown in large digits preceded by the units "Hz". If using version 2.00 software onwards, also refer to section on "0.1Hz resolution".
FREQ DOWN	To decrement the tuned frequency by 1 Hz. The tuned frequency is shown in large digits preceded by the units "Hz". If using version 2.00 software onwards, also refer to section on "0.1Hz resolution".
I/P Z	To toggle between 1MΩ or 1kΩ (or 1k5Ω) for the voltage input impedance. The input impedance status is shown next to the voltage measurement reading. 1M = 1MΩ

Key Label	Key function in DMM mode
	1k = 1kΩ 1k5 = 1k5Ω
FILTER	Toggles the update rate of the measurements, in the following sequence: SLOW → MED → FAST → SLOW and so on… SLOW rate – measurements are updated approximately every second. This update rate provides the best measurement in terms of rejection of all other frequencies, as well as more stable readings due to averaging over many cycles. This update rate is recommended for all measurements. MEDium rate – measurements are updated after sampling and processing 16 full cycles of the measured signal (0.25 sec (at 69Hz) to 0.4 sec (at 40Hz)). Measurements are not as steady compared to the slow rate. FAST rate – updated after sampling and processing just 1 full cycle of the measured signal. Measurements are the least steady compared to the slow and medium rate. If using version 2.00 software onwards, also refer to section on “0.1Hz resolution”.
BNC	This button is reserved for future use. It is intended to select the input signal (Volts, Rogowski or Lem) to be connected to the BNC output. The signal on the BNC output is always an amplified or attenuated filtered and conditioned signal of the selected input. Presently, the BNC output is fixed to output the current sensed by the Rogowski coil only.
F1, F2 F4, F5, F7 to F9	These keys are reserved for future use.

2.6.3 123 mode

This mode is intended to be used to select the user menu options, enter numerical test settings, etc… as well as to delete previous characters.

The following table describes the various keys available for 123 mode, and what each key does:

Table 3. Key functions in 123 Keypad mode.

Key Label	Key function in 123 mode
0 - 9	Enter numbers 0 to 9, or Selects the menu options depending on menu state
. (dot)	Enters a decimal point or dot character.
Left Arrow	Move cursor to the left one space and deletes previous character entered, or Selects the menu options depending on menu state.
Right Arrow	Selects the menu options depending on menu state.

Key Label	Key function in 123 mode
Up Arrow	Selects the menu options depending on menu state.
Down Arrow	Selects the menu options depending on menu state.
DEL	Reserved for future use. (Intended to move cursor to the leftmost position, and delete all previous character entered).
BSPACE	Reserved for future use. (Intended to move cursor to the left one space and deletes previous character entered).
ENTER	To enter the required setting or number, and proceed to the next screen in the menu options.

2.6.4 ABC mode

This mode is intended to be used to enter alphabet characters (e.g. operator id, device number, etc…) where applicable when operating the menu.

The following table describes the various keys available for ABC mode, and what each key does:

Table 4. Key functions in ABC Keypad mode.

Key Label	Key function in ABC mode
A - Z	Enter alphabet characters A to Z (capitals only)
SPACE	Enters a space character e.g. when entering a name.
ENTER	To enter the required setting or number, and proceed to the next screen in the menu options.

2.6.5 Keys not applicable to the present keypad mode

Pressing any key that is not applicable (or reserved for future use) to the present keypad mode, will not do anything, except for the usual short quiet beep. In these cases, a '?' character is displayed to the right of the "lcd twirler" on the screen.

2.7 Multimeter operation

To operate the 4025D as just a multimeter, the user is not required to interact with the menus at all.

Simply set the keypad mode to DMM, and just use the keys applicable to DMM mode to change the various multimeter settings.

2.8 0.1Hz Frequency Resolution

Version 2.00 of the instrument software was introduced allowing the instrument to discriminate signals to 0.1Hz resolution. Thus the selected or tuned frequency of interest may also be set to the same 0.1Hz resolution. This version was introduced from September 2009.

0.1Hz resolution measurements should only be used provided the injection source is also settable to 0.1Hz resolution. Otherwise, it is recommended to only perform measurements at 1Hz resolution.

The behaviour of several keys was revised as shown in the table below.

Table 5. Keys revised for 0.1Hz resolution in DMM keypad mode.

Key Label	Key function in DMM mode
FREQ UP	To increment the tuned frequency by 1.0 Hz.
FREQ DOWN	To decrement the tuned frequency by 1.0 Hz.
UP	To increment the tuned frequency by 0.1 Hz. Any frequency setting not a multiple integer of 1.0 Hz (e.g. 50.1, 50.2, 50.7, etc…) will automatically change the filter setting to NARROW.
DOWN	To decrement the tuned frequency by 1.0 Hz. Any frequency setting not a multiple integer of 1.0 Hz (e.g. 50.1, 50.2, 50.7, etc…) will automatically change the filter setting to NARROW.
FILTER	Toggles the filter settings of the measurements, in the following sequence: NRRW → WIDE → NRRW and so on… NARROW filter: used for measurements requiring 0.1Hz frequency discrimination/resolution. Measurement readings will settle to final value 10 seconds after the frequency and/or range are changed. Afterwards, readings are updated approximately every 0.5 seconds. While readings are not yet settled, an hourglass symbol (⌛) will appear on screen. WIDE filter – suitable for measurements requiring 1.0Hz frequency discrimination/resolution. Measurement readings will settle to final value 1 second after the frequency and/or range are changed. Afterwards, readings are updated approximately every 0.5 seconds. While readings are not yet settled, an hourglass symbol (⌛) will appear on screen.

2.8.1 Version 2.00 software not backward compatible

Version 2.00 is not backward compatible with instruments initially shipped with earlier software versions (v1.xx). Instruments shipped with v1.xx were configured differently internally compared to instruments shipped with version 2.00 onwards.

2.9 Charging the internal battery

The internal 6V sealed lead acid battery may be charged by following these steps:

1. Disconnect all inputs (Volts, Rogowski and Lem) from the input terminals on the front panel, including the BNC and USB connections.
2. Connect an IEC mains lead to the IEC socket on the front panel, and switch on the mains supply.
3. During charging, the Charge LED is lit to indicate that the internal charger power supply is ON and charging the battery. *Note: Do not take any measurements while the battery is charging.* The internal *charger* power supply radiates significant amounts of electrical noise and will affect the measurement circuit.
4. Once charging is completed, the Full LED (green) will be lit to indicate the internal battery is fully charged.

CAUTION:
Do NOT charge the internal battery with the instrument's "Pelican" case closed. This is to avoid a build up of hydrogen gas that is produced from charging the battery. Always charge the internal battery with the instrument's "Pelican" case OPEN and placed in a well-ventilated area.

2.9.1 Maximise battery life

In order to maximise the life of the battery:

- Do not allow battery to be left discharged for a prolonged period of time.
- Avoid operating instrument for a long period of time without charging the battery.
- Charge the internal battery at regular intervals to maximise its life.
- Store instrument and any spare battery in a cool location away from direct sunlight.

2.9.2 Battery voltage

The 4025D will also monitor the battery voltage and display its voltage just above the "battery charge status" icon. The battery voltage is measured approximately every 30 seconds.

If the battery voltage is below 5.4V, the battery charge icon will change to a "Low Batt" status. 5.4V is roughly the "knee point" on the "voltage vs. current" consumption chart for this type of battery. It is recommended that the battery be re-charged as soon as possible.

Generally the measurements are not affected, and still within specification, even down to a battery voltage of 5.4V.

It is recommended that the battery be recharged immediately should it fall to 5.0V or lower. At this level, the LCD backlight will noticeably dimmer.

3. Menu Operations

The menus are available to allow the user to access more detailed features of the instrument.

Via the menus the user may be able to perform the following operations:

- Setup various test settings, so that when measurements are saved, these various test settings are also saved to the test records, stored in internal memory.
- View, browse, delete and download test records stored in memory.
- Adjust date and time.
- View, browse, edit and download calibration constants. (This feature is available with entry of the correct operator id).

Most of the menu screens should be self explanatory, and the menu screens are not repeated here.

This section will describe in more detail some of the details which require further explanation as to what is available.

3.1 Tests available

After entering the operator id or name, the user should see an option to proceed to the main test screen.

From this screen, the following tests are available:

1. Ground Impedance
2. Touch Potential Voltage
3. Step Potential Voltage
4. Surface Potential Voltage

3.1.1 Ground Impedance Test

After selecting this test, the operator is required to enter the following information:

Table 6. Ground Impedance Test Settings.

Test Data Fields	Description of data fields
Substation Id	Up to 16 substation Id may be saved to internal memory. The user is required to select one of the 16 substation names to be tested (0 to 15)
Substation Name	Edit the name of the substation selected, if required. Up to 31 characters may be entered. *Note:* Any previously saved test record already stored in internal memory, using the same substation Id number will also have its name changed when the test records are downloaded. It is recommended to always select a substation id that has not been used previously. If all substation id have been used previously, download all test

Test Data Fields	Description of data fields
	records first then erase all test records, prior to editing the selected substation name.
	After “starting the test”, selecting the “Save reading” option will save the measurement results shown along with the above settings entered.

3.1.2 Touch Potential Voltage

After selecting this test, the operator is required to enter the following information:

Table 7. Touch potential voltage test settings.

Test Data Fields	Description of data fields
Device Under Test	Select the device under test from one of the following options: • Power Switch / Breaker • Transformer • Lightning Arrestor • Truss • CT/PT • Power distribution box
Device number/ Name	Edit the device number/name, if required. This could be a serial number of the device, etc… Enter any alphanumeric character as required. Up to 15 characters may be entered. Each test record can store a unique name for each device tested.
	After “starting the test”, selecting the “Save reading” option will save the measurement results along with the above settings entered. More than 1 test record may be saved with the same setting, if required.

3.1.3 Step Potential Voltage

After selecting this test, the operator is required to enter the following information:

Table 8. Step Potential voltage test settings.

Test Data Fields	Description of data fields
Start X coordinate	Enter the X coordinate of the starting location, in metres. No decimal points.
Start Y coordinate	Enter the Y coordinate of the starting location, in metres. No decimal points.
Direction	Select the direction for the measurements: • East to West

Test Data Fields	Description of data fields
	• West to East • North to South • South to North Notes: The x and y coordinates will be updated automatically after each measurement is saved, according to the direction selected, and the X and Y direction entered. X coordinate will increment in the East direction and decrement in the West direction. Y coordinate will increment in the North direction and decrement in the South direction.
X step Size	Enter the X increment for each measurement point, in metres. No decimal point. *Note*: Enter only the absolute step (no minus sign required, as the next location is calculated automatically from the direction previously selected).
Y step Size	Enter the Y increment for each measurement point, in metres. No decimal point. *Note*: Enter only the absolute step (no minus sign required, as the next location is calculated automatically from the direction previously selected).
	After "starting the test", selecting the "Save reading" option will save the measurement results along with the above settings entered, including the coordinates entered. After each save, the next location is set automatically. To repeat the measurement at the previous location, select "Prev". Wait for measurement to update, then select save. To skip the measurement at the next location, select "Next". More than 1 test record may be saved with the same setting, if required.

3.1.4 Surface Potential Voltage

After selecting this test, the operator is required to enter the following information:

- Curve settings (including coordinates and direction)
- Substation details (x and y length)
- Then start the test.

Table 9. Surface potential voltage test settings.

Test Data Fields	Description of data fields

Test Data Fields	Description of data fields
Curve Name Id	Up to 16 Curve Name Id may be saved to internal memory. The user is required to select one of the 16 curve names to be tested (0 to 15)
Curve Name	Edit the name of the curve selected, if required. Up to 31 characters may be entered. *Note:* Any previously saved test record already stored in internal memory, using the same curve name Id number will also have its name changed when the test records are downloaded. It is recommended to always use the curve name for the same substation to be tested, as there are likely to be many measurements taken at the same substation. It is also recommended to always select a curve name id that has not been used previously. If all curve name ids have been used previously, download all test records first then erase all test records, prior to editing the selected curve name.
Direction	Select the direction for the measurements: • West to East • South to North • Diagonal: South-West • Diagonal: North-West Notes: The x and y coordinates will be updated automatically after each measurement is saved, according to the direction selected, and the X and Y direction entered. X coordinate will increment in the East direction and decrement in the West direction. Y coordinate will increment in the North direction and decrement in the South direction.
Start X coordinate	Enter the X coordinate of the starting location, in metres. No decimal points.
Start Y coordinate	Enter the Y coordinate of the starting location, in metres. No decimal points.
X step Size	Enter the X increment for each measurement point, in metres. No decimal point. *Note*: Enter only the absolute step (no minus sign required, as the next location is calculated automatically from the direction previously selected).
Y step Size	Enter the Y increment for each measurement point, in metres. No decimal point. *Note*: Enter only the absolute step (no minus sign required, as the next location is calculated automatically from the direction previously selected).

Test Data Fields	Description of data fields
Substation X length	Enter the X length of the substation in metres. No decimal point.
Substation Y length	Enter the Y length of the substation in metres. No decimal point.
	After "starting the test", selecting the "Save reading" option will save the measurement results along with the above settings entered, including the coordinates entered. After each save, the next location is set automatically. To repeat the measurement at the previous location, select "Prev". Wait for measurement to update, then select save. To skip the measurement at the next location, select "Next". More than 1 test record may be saved with the same setting, if required.

3.2 Test Records

Measurements saved to internal memory are referred to as test records, or just as records.

From the Records main menu, the user may perform the following operations:

- Browse records
- Erase a single record or all records
- Download records

3.2.1 Erasing test records

Test records are stored in internal memory in a circular buffer method.

The user is not able to specify the record number when saving any measurement.

After any single test record is deleted, that test record is simply marked as deleted.

Erasing all test records will delete all test records, and reset the total number of test records stored to zero.

Test records are saved starting at record #1 and the next available slot is incremented automatically each save. The total number of test records stored is also incremented. Up to 7000 records may be saved. After the 7000th record is saved, the next available slot is reset to slot #1. Any further saves will overwrite any existing test record previously saved to the same slot.

3.2.2 Browsing test records

Each test record contains all test settings relevant to the test that was performed at the time.

Details of each test record can be viewed from the View Rec screens, over multiple screens or pages.

To go to the next or previous page of the same record, press the Up or Down Arrow button.

To view a different record, press the Left or Right Arrow button.

3.2.3 Downloading test records

Test records may be downloaded to a PC via the USB interface on the front panel.

To perform a download of the test records, the following procedure must be completed:
1. Connect a USB cable between the PC and 4025D. This cable is provided.
2. Install the USB drivers on the PC (only needs to be done once).
3. Start Hyperterminal, configure the comm port settings to suit and initiate capture of data from the Hyperterminal menu.
4. Select the Records → Download All option on the 4025D menu.

Further details are provided in the appendix on how to complete the above procedure.

3.3 Calibration

The calibration menu is available if the correct operator Id is entered.

Under normal use, access to the calibration menu is not required. The calibration menu is always intended for use by Red Phase Instruments mainly for calibration purposes only.

From the calibration menu, the following functions are available:
1. Edit, reset and download of all calibration constants.
2. Calibration routines (Note: these routines are intended to be used by Red Phase Instruments only).

4. Specification

4.1 Performance specification

Parameter	Specification	Notes
Frequency range	40 - 69 Hz	
Frequency increment	1 Hz	1Hz resolution applicable to instruments shipped prior to September 2009 with software v1.xx.
	0.1Hz (Software v2.00 onwards only).	0.1Hz resolution is only applicable to version 2.00 onwards, instruments shipped from September 2009 onwards.
Magnitude Linearity Error	< 1% FS	
Magnitude Error	< 1% FS	
Phase Angle Error	< 1° max, +/- 3 counts	
Rogowski Input error due to crosstalk from voltage input	±2% (or ±40 counts) on 200mA range, ±0.2% (or ±4 counts) on 2A range,	With 200V applied on voltage input at the same time With 200V applied on voltage input at the same time
Typical 50Hz or 60Hz noise attenuation:	-42 dB min	+/- 1 Hz of power frequency
	-48 to –60 dB	> +/- 3 Hz of power frequency
	–54 to –64 dB	> +/- 5 Hz power frequency
	–60 to –74 dB	> +/- 10Hz power frequency
50Hz or 60Hz Noise overload level:	+17.5dB typically above nominal full scale.	Except for 200V range, Absolute limit of 240V max on this range.
Voltage Ranges	20mV, 200mV, 2V, 20V and 200V	Nominal ranges
Voltage Input Isolation Rating	1000V DC 700V AC	**Note:** The voltage input is isolated for instruments manufactured from end of July 2009 onwards (ie. serial numbers 6145 onwards).
Rogowski Coil Ranges	200mA, 2A, 20A and 200A	Nominal ranges
Lem Ranges	3V	Nominal range
BNC output	Amplified & filtered Rogowski signal: 200mV at nominal full scale input ± 2% FS	Fixed to Rogowski coil, amplified and filtered signal. 200mV = 200A on 200A range 200mV = 20A on 20A range 200mV = 2A on 2A range 200mV = 200mA on 200mA range

Parameter	Specification	Notes
Rogowski BNC Output signal Phase angle error	2.1° lag typical at 40Hz 4.3° lag typical at 60Hz 4.9° lag typical at 69Hz	
Test record storage capacity	7000 records	Non-volatile internal memory
Battery life	8 to 10 hours	Without backlight Down to battery voltage of 5.25V
	5 to 6 hours	With backlight Down to battery voltage o 5.25V
Battery capacity	6V 4.2Ah + 3V lithium coin battery for real time clock	seal lead acid type
Maximum power consumption	3.5 Watts	Including LCD backlight
LCD backlight consumption	1.3 Watts	

4.2 Size and Weight

Parameter	Specification	Notes
Dimensions	345 x 300 x 150 mm	(W x D x H)
Weight	5.5 kg approx	
Dimensions, packed in transit case	430 x 370 x 390 mm	(W x D x H)
Weight with transit case	9.5 kg approx	

4.3 Enclosure Packaging

The unit is housed in a fully molded light weight case.

The case offers high resistance to impact, thermal shock, moisture, weather, and corrosion. The front panel is covered with a polycarbonate label for durability and appearance.

5. Operating Manual Change History

Table 10. Operating Manual Change History.

Document Version	Change Description
1.00 24 Sep 2008	Initial creation.
1.10 07 Oct 2008	Added firmware update in appendix.
1.20 24 Nov 2008	Added details on Rogowski and Fluke coil module as appendices.
1.30 27 Nov 2008	Added further details about the BNC output in the BNC output section and corrected its specification at 69Hz. Lem input is also referred to as the coil module input.
1.40 06 March 2009	Updated section on measurement at the mains supply frequency. The 4025D with firmware *version 1.23* onwards is now able to measure accurately the signals at the mains supply frequency (50 or 60Hz).
1.50 31 March 2009	Added safety warning about the voltage input connections.
2.00 28 Oct 2009	Added details about isolated voltage input versions. Added details about 0.1Hz resolution measurements applicable to the relevant buttons and specification. Added "—OR—" indication when input exceed nominal range limit.

6. Appendix A: Downloading of Test Records

Test records stored in the instrument may be transferred to a user PC by performing the download function from the menu options of the LCD and keypad. The test records can then be stored, printed or processed further as required on the users' PC.

This section of the manual assumes the reader is familiar with setting up a USB connection, setting up a comm port connection on a PC, as well as familiarity with the Windows software HyperTerminal and Excel.

6.1 USB Interface

Test records from the 4025D are transferred to the PC over a USB cable.

The user must complete the following steps in order to download data from the instrument:
1. Obtain a standard USB cable with an A type connector at one end and B type connector at the other end.
2. Install the USB drivers to the PC connected the instrument.
3. Configure the virtual comms port under Hyperterminal

6.1.1 Installing the USB drivers

FTDI Virtual Comms Port driver
Obtain the required FTDI Virtual Comms Port driver from the agent or at the FTDI website (www.ftdichip.com). The required driver version is 2.00 or greater. (File is called CDM 2.00.00.zip for version 2.0. Note that version 2.0 is NOT Microsoft WHQL certified. However, version 2.02.04 is now available and IS Microsoft WHQL certified).
1. Download or obtain the required FTDI CDM driver from the agent or the FTDI website.
2. Unzip the files to a known location or folder on the PC e.g. c:\FTDI Driver.

Install the driver
Follow the steps below to install the USB drivers to the PC:
1. Ensure PC is ON and **NOT connected** to the internet. (**Warning**: Having the PC connected to the internet the very first time the 4025D is connected to PC will cause a wrong USB driver to be installed in the PC.)
2. Switch ON 4025D.
3. Connect the USB cable to the PC and to the 4025D USB interface on the front panel.
4. Windows will then automatically detect the USB device as a Model 4025D Multimeter. Windows will then prompt user for the correct USB driver. Follow the on screen prompts and direct Windows to the location of the FTDI drivers from the above steps.
5. After the driver has been installed, the USB connection to the model 4025D will appear under the Device Manager as a new COM port. In other words, the connection to the 4025D from the PC is now established via a "virtual com port" even though the physical connection is over a USB cable. Identify the COM port number in order to setup Hyperterminal properly.

Important Notes:
1. Subsequent connections of the 4025D to any of the PC USB may not always appear at the same COM port number, particularly if PC USB interface is changed. Always identify the COM port number under the Device Manager window.
2. Only one Model 4025D may be connected to the same PC at any time.

6.2 Virtual Serial Comm Port Configuration

The virtual serial comm port must be configured as follows, typically done under Hyperterminal:

- 9600 bps
- 8-bit data
- No parity
- 1 stop bit
- No hardware or software control

6.3 Capturing the data from the 4025D USB Interface

The user PC must have application software capable of reading the serial data stream on the (virtual) serial port. One example of suitable application software is called HyperTerminal, available on the Windows operating system. The “capture text” function within HyperTerminal may be used to capture the data from the 4025D instrument via its USB interface on the front terminal.

After connecting the PC to the 4025D with the USB cable, the user needs to configure the HyperTerminal COM port settings to match the serial port configuration as described above. Then do the following:

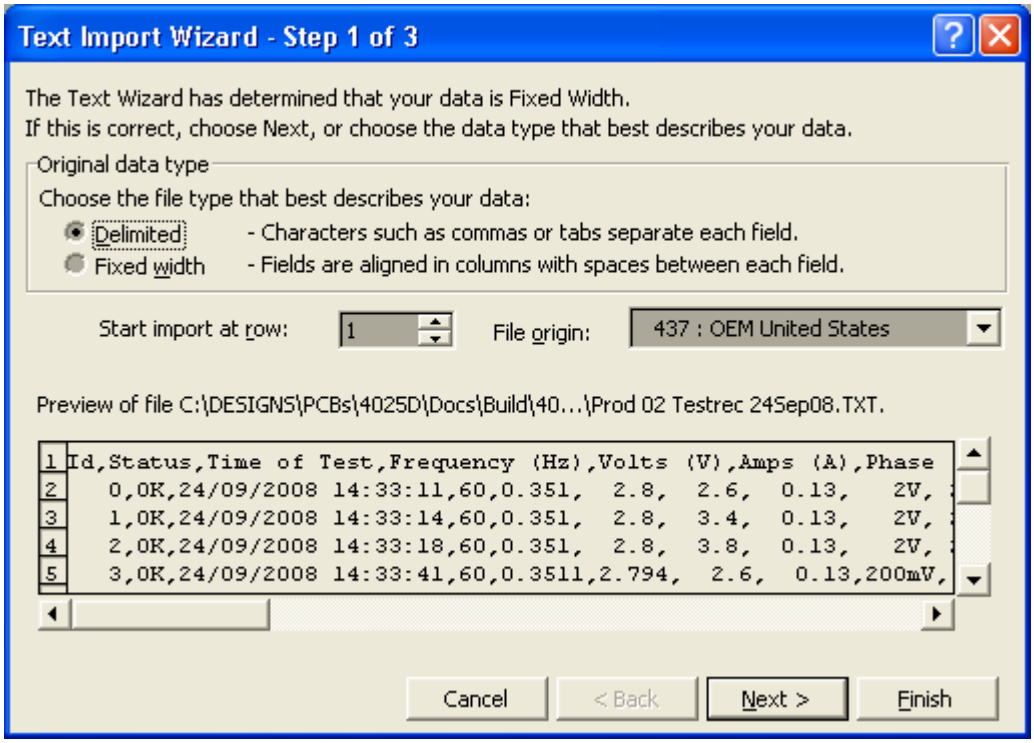
1. Under Hyperterminal, enable the “Capture Text” function in order to record the test data to a file. (E.g. use a descriptive filename such as 4025D test data.csv).
2. On the 4025D menu, start the Records download as described in the section “Downloading Test Records”.
3. After all the test records data is transferred, stop the “Capture Text” on Hyperterminal.

6.4 Data in CSV format

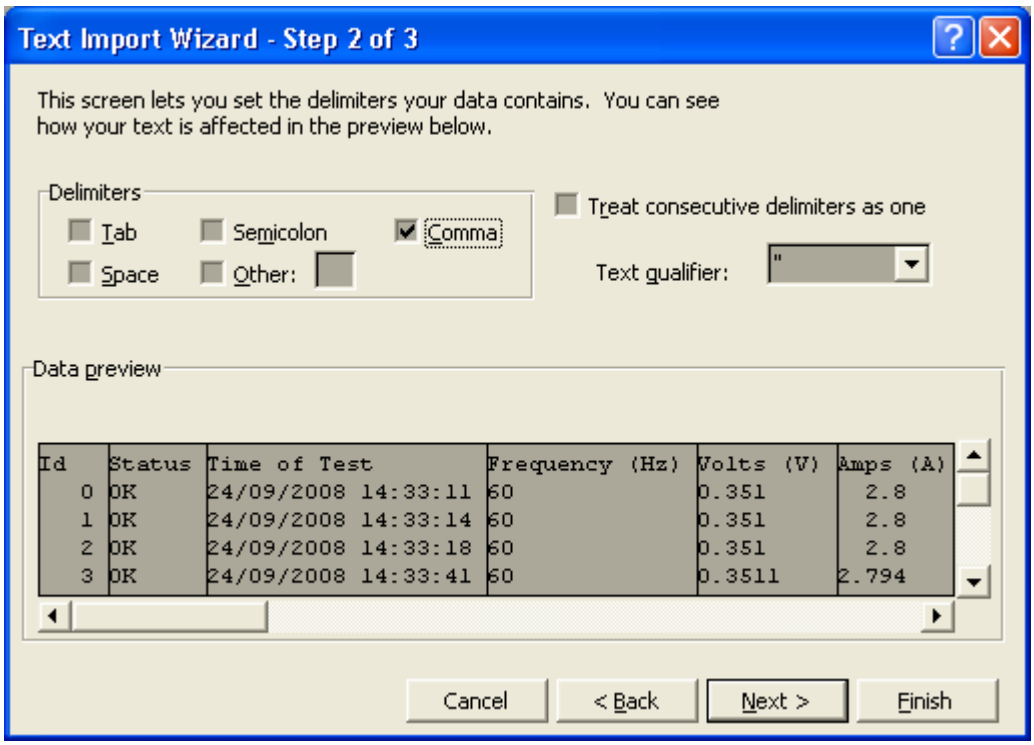
The data captured can be saved as a text file. As the saved data is sent from the 4025D in csv format (comma delimited), the text file contains data in a csv format .

This text file can be imported in the Windows Excel application. Simply open this file directly from Excel.

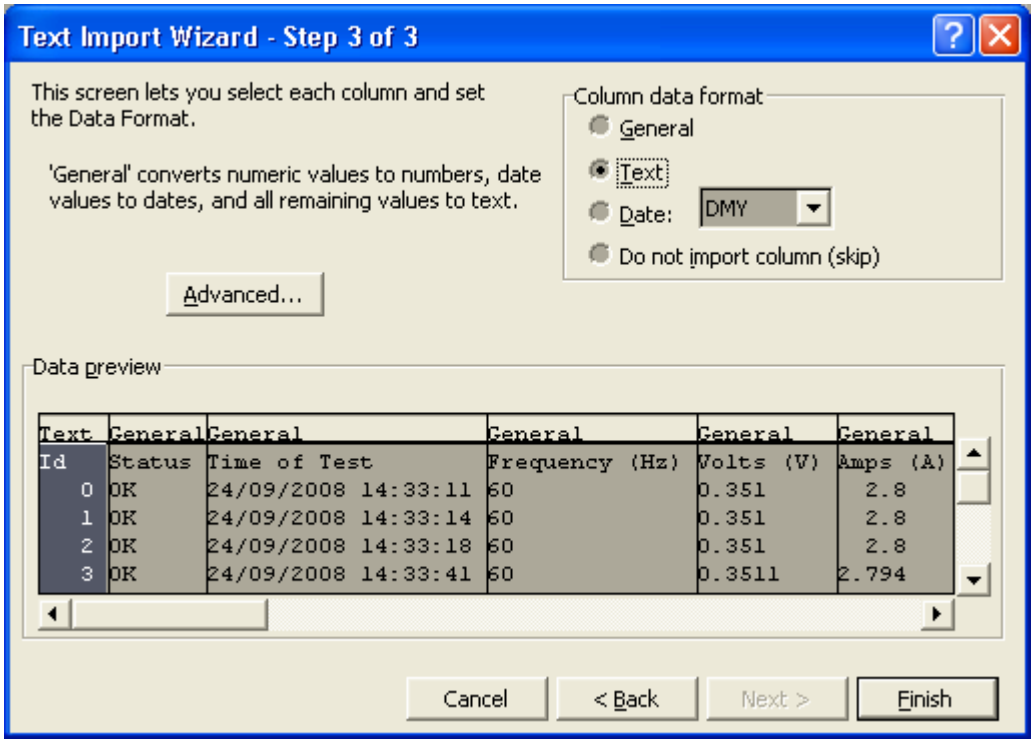
Excel will then pop up the Text Import Wizard as shown in the picture below. Select the “Delimited” option.



Then check the Comma option for the delimiter.



Then select each column and check the “text” option as shown in the screen below. The user may optionally do this for every column to be imported. This is only to ensure that Excel will present all data correctly, and avoid truncation of any trailing zeroes in numbers, etc…



Then click the Finish button.

Then the user can process the data further as required within Excel.

7. Appendix B: Firmware Update instructions for 4025D

The firmware may be updated via a 2nd USB interface located inside the instrument, located on the main board. This procedure requires the instrument to be removed from its Pelican case. (Do not confuse this 2nd USB interface with the USB interface on the front panel.)

In general, the instrument should be returned to the agent or Red Phase Instruments for software updates.

The procedure involves the following major steps:
1. Obtain the new firmware update from Red Phase Instruments representative. The firmware is usually a binary file eg. Instrument_v1_00.bin
2. Remove instrument from pelican case to access the 2nd USB port and associated DIP switches.
3. Install Atmel's SAM-BA software.
4. Perform a flash erase of the micro on the main board.
5. Connect PC to 2nd USB port.
6. Install USB driver from Atmel for 2nd USB port on the PC.
7. Run SAM-BA and update instrument firmware.
8. Put instrument back in its Pelican case.

Note: The software cannot be updated via the USB interface on the front panel.

7.1 Obtain latest instrument firmware

Contact agent or Red Phase Instruments directly to obtain latest firmware as a binary file.

7.2 Remove instrument from its hardcase

1. Ensure instrument is switched off and disconnect all test leads and cables from front panel.
2. The instrument can be removed from its hardcase by removing 4 screws located on the base (ie. bottom side) of the Pelican case.
3. Then carefully lift the instrument panel out of the Pelican case. Do so by lifting it gently by holding the large terminals on the front panel and lifting it up.
4. Remove the four (4) screws along the side of the metal panel to open up the instrument to access the main board (RPI 4025D-1).

7.3 Install SAM-BA software

Install version 2.5 of Atmel's SAM-BA application. Contact agent or Phase Instruments directly to obtain a copy. SAM-BA is also available from Atmel's website.

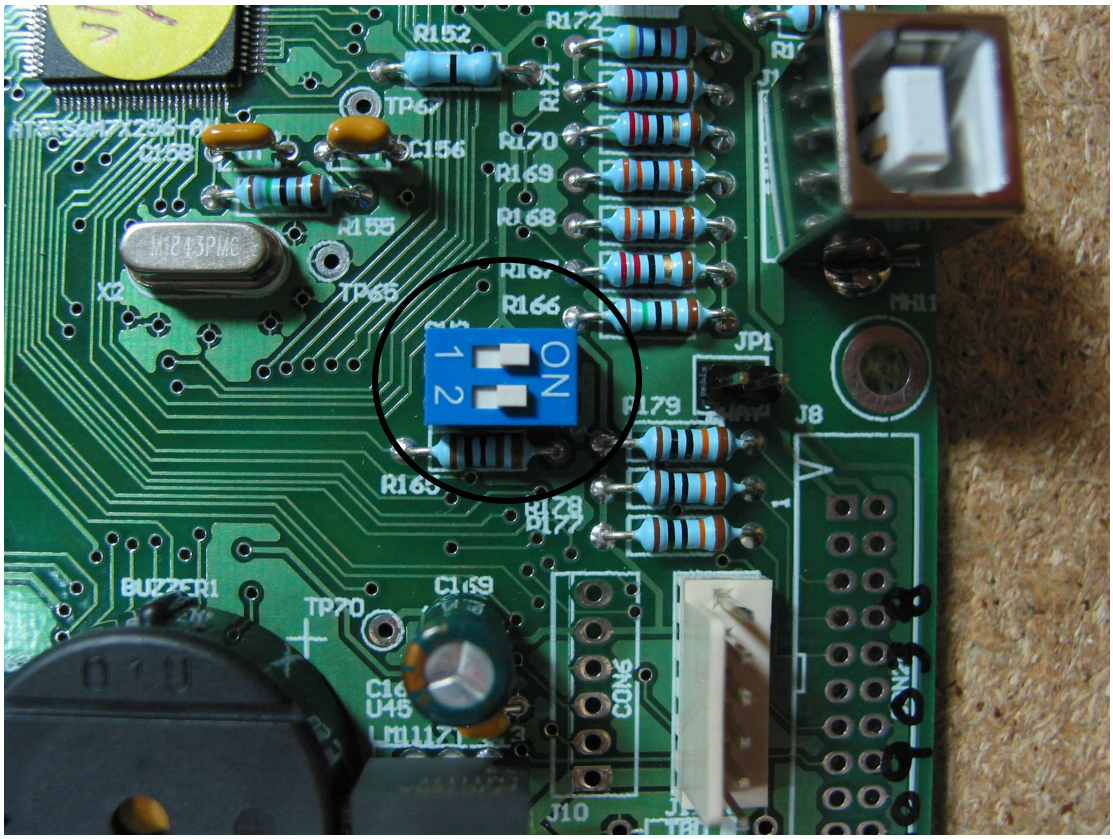
This only needs to be performed once on the PC to be used to make the firmware updates.

7.4 Perform an initial flash erase of the micro

1. Ensure instrument is initially OFF and disconnect all test leads and cables from front panel.
2. On the main board, locate the **ERASE** dip switch **SW3**. Refer to Photo 1 for the location on the board.

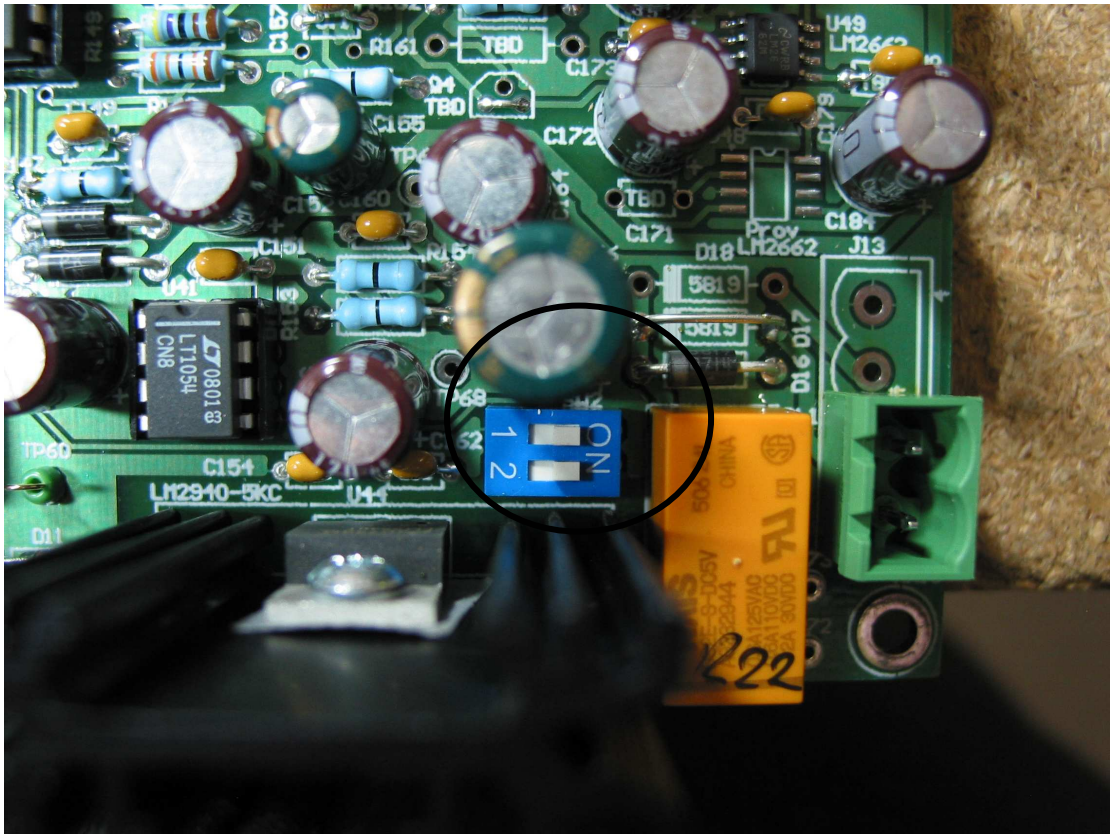
3. Change SW3 Erase switch to position to ON as shown in Photo 1 (slide the switch to ON). Refer to photos below.

Photo 1. Erase dip switch SW3 (ON) on main board.



4. Then locate the **POWER** dip switch **SW2** on the main board. Refer to Photo 2.
5. Change SW2 to ON setting as shown in Photo 2. By setting SW2 this way, instrument will switch ON (and stay on to be able to complete firmware update.)

Photo 2. POWER dip switch set to ON.



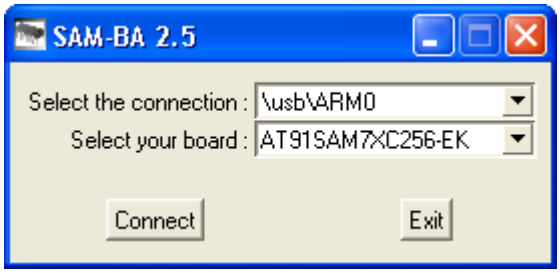
6. After instrument has switched on, wait about 10 seconds, to allow the existing firmware in the micro to be erased. Then proceed to next section.

7.5 Connect PC to 2nd USB port & Install Driver

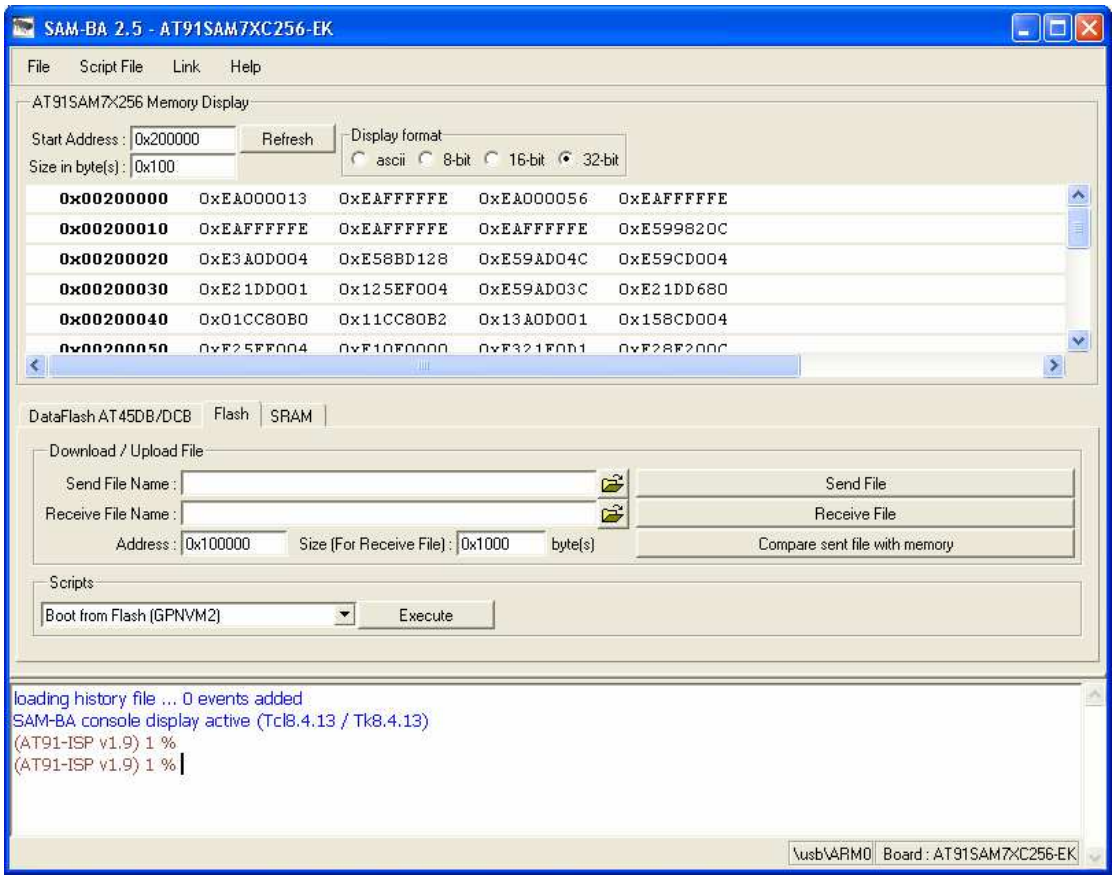
1. Using a USB cable, connect PC to 2nd USB port labelled **J12** on the main board. Windows will automatically detect the board.
2. If this is first time instrument has been connected to PC, Windows will attempt to install the correct USB drivers. If this is the case, follow the prompts, let Windows choose the driver automatically and allow Windows to install USB driver as "**atm6124.sys**".

7.6 Run SAM-BA and update firmware

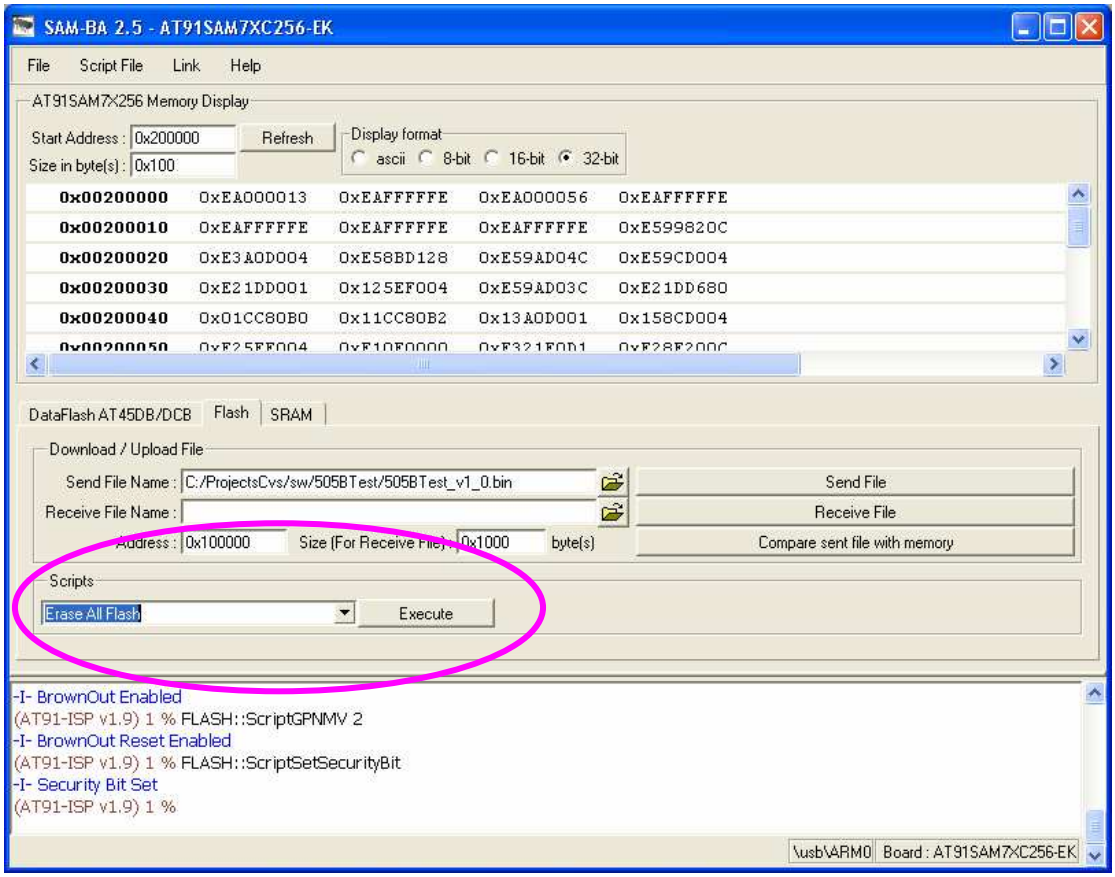
1. Start SAM-BA version 2.5
   Make the selection as shown on the screen below.
   That is:
   Select connection as: **\usb\ARM0**.
   Select board as: **AT91SAM7XC256-EK**.
   Then click Connect button.



2. The following SAM-BA main screen will then appear.

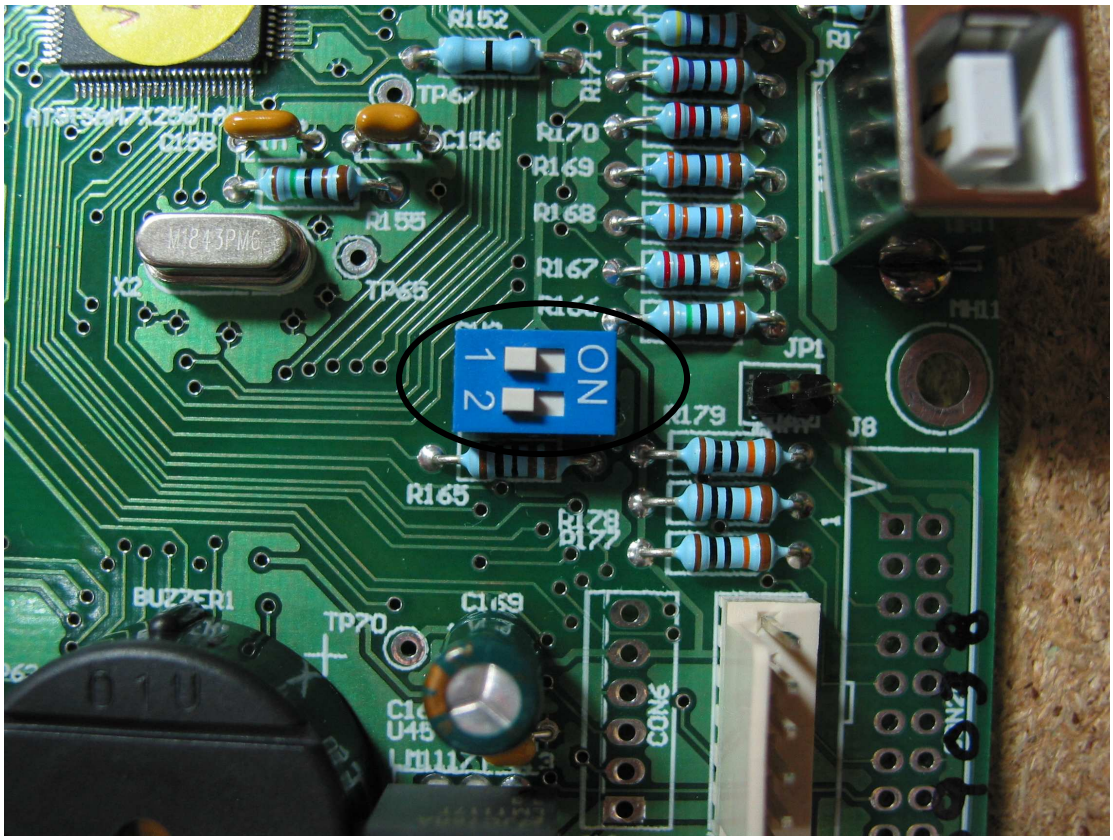


3. Select “Erase All Flash” under scripts. Then click Execute button to perform erase of entire flash.



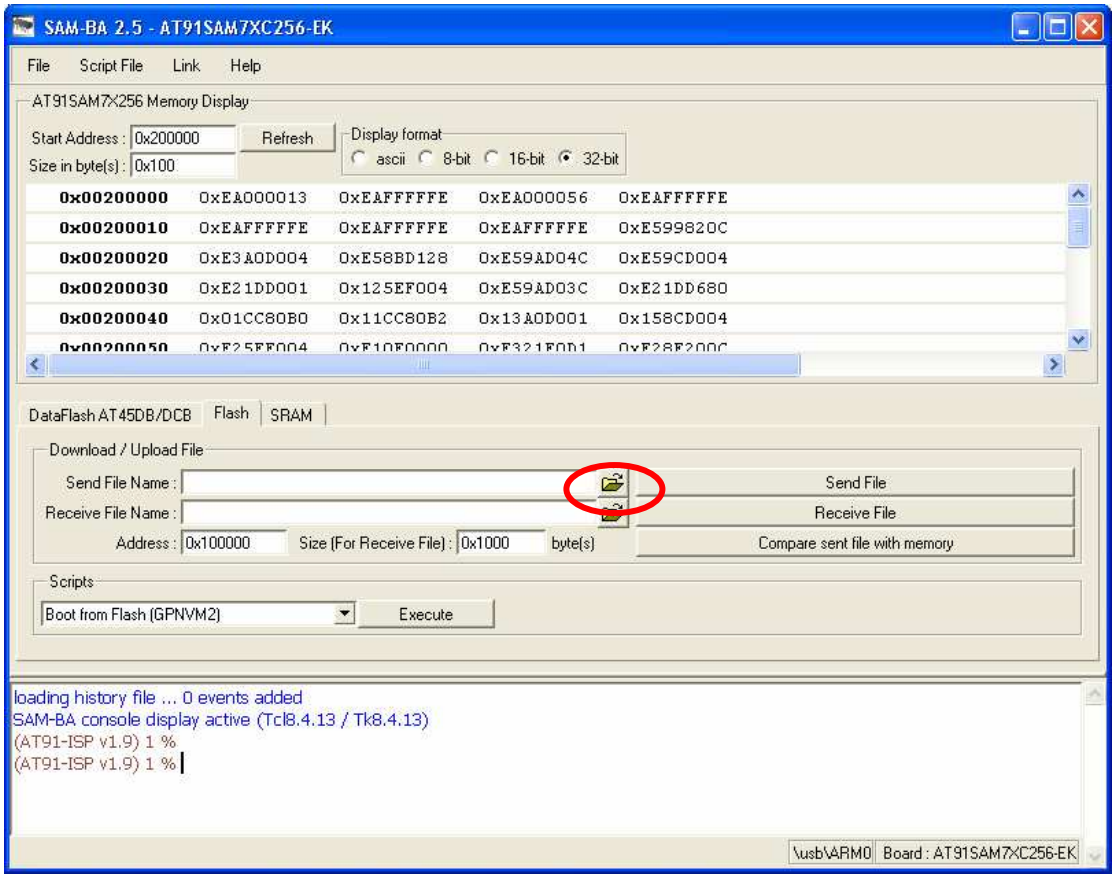
4. Next, restore Erase SW3 to original factory setting, as shown in Photo 3.

Photo 3. Erase dip switch SW3 disabled on main board (factory setting).

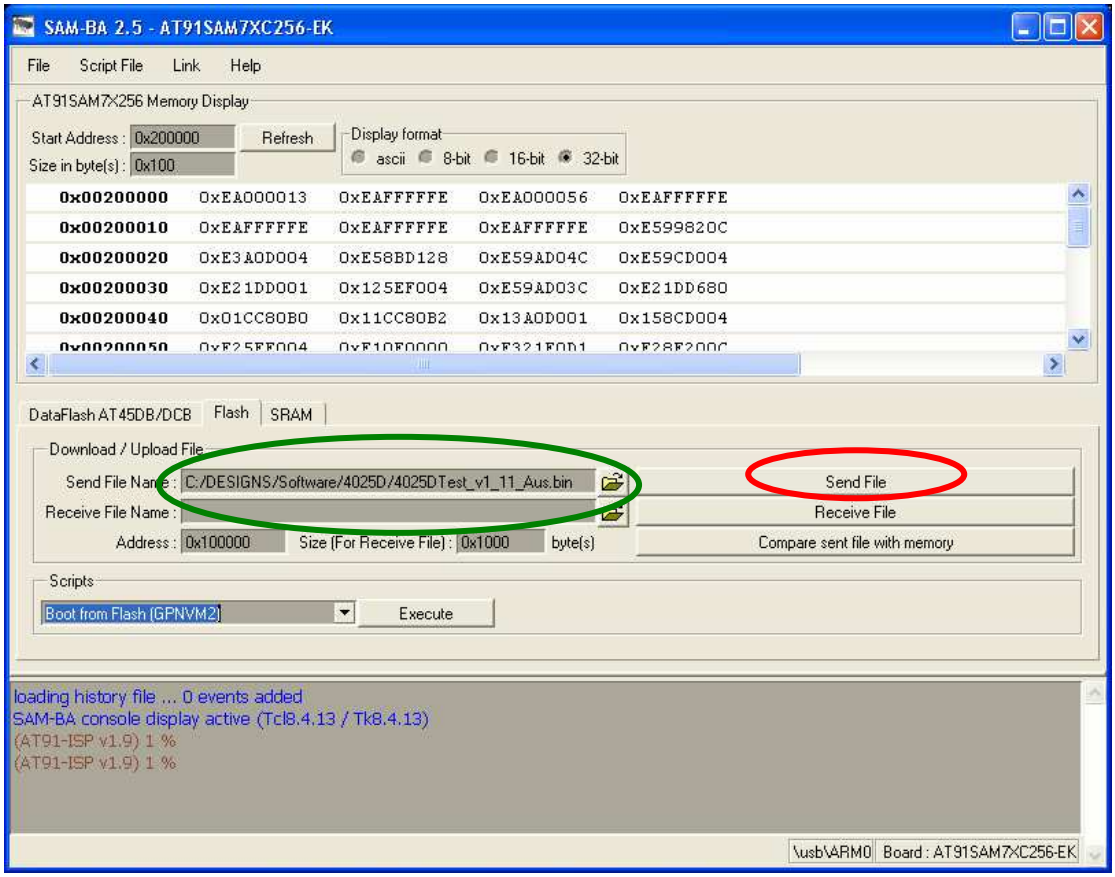


5. Now cycle power to instrument by switching OFF Power dip switch SW2. Wait a few seconds. Then switch SW2 back ON again (as per step 5 above in previous section).
6. Then quit SAM-BA and restart SAM-BA again. Then re-connect to board again.

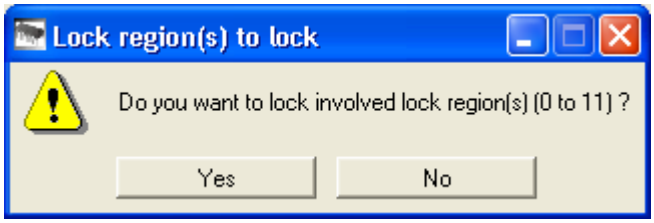
7. To program micro with latest software, a send file must first be selected (ie. Open). The send file is the binary file obtained from the agent or Red Phase Instruments. Click on Open File button circled in red as shown below. Then browse to where the binary file for the latest instrument software is located on your PC hard disk or network e.g. 4025DTest_v1_11.bin, or whatever the latest version and filename is called.



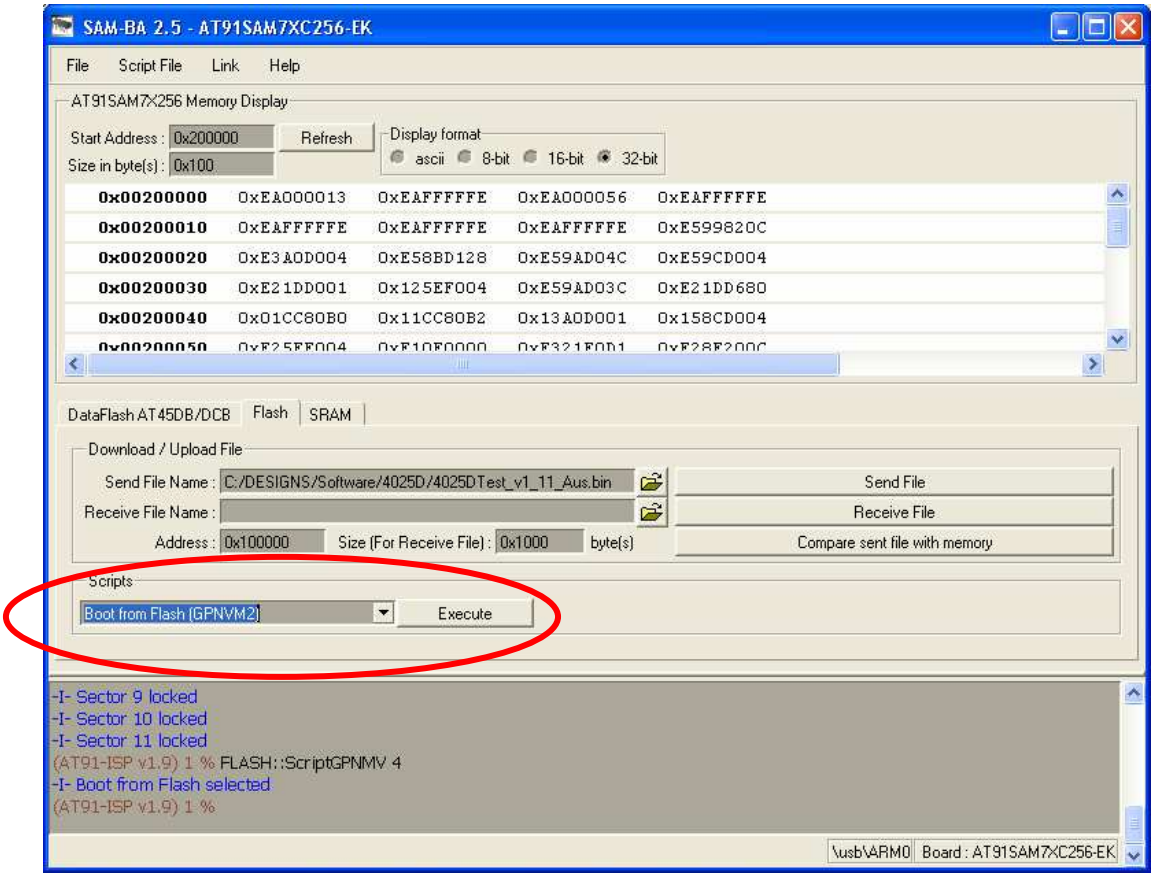
8. After binary file has been selected, click on Send File button. SAM-BA will then program the selected binary file into the micro's flash memory.



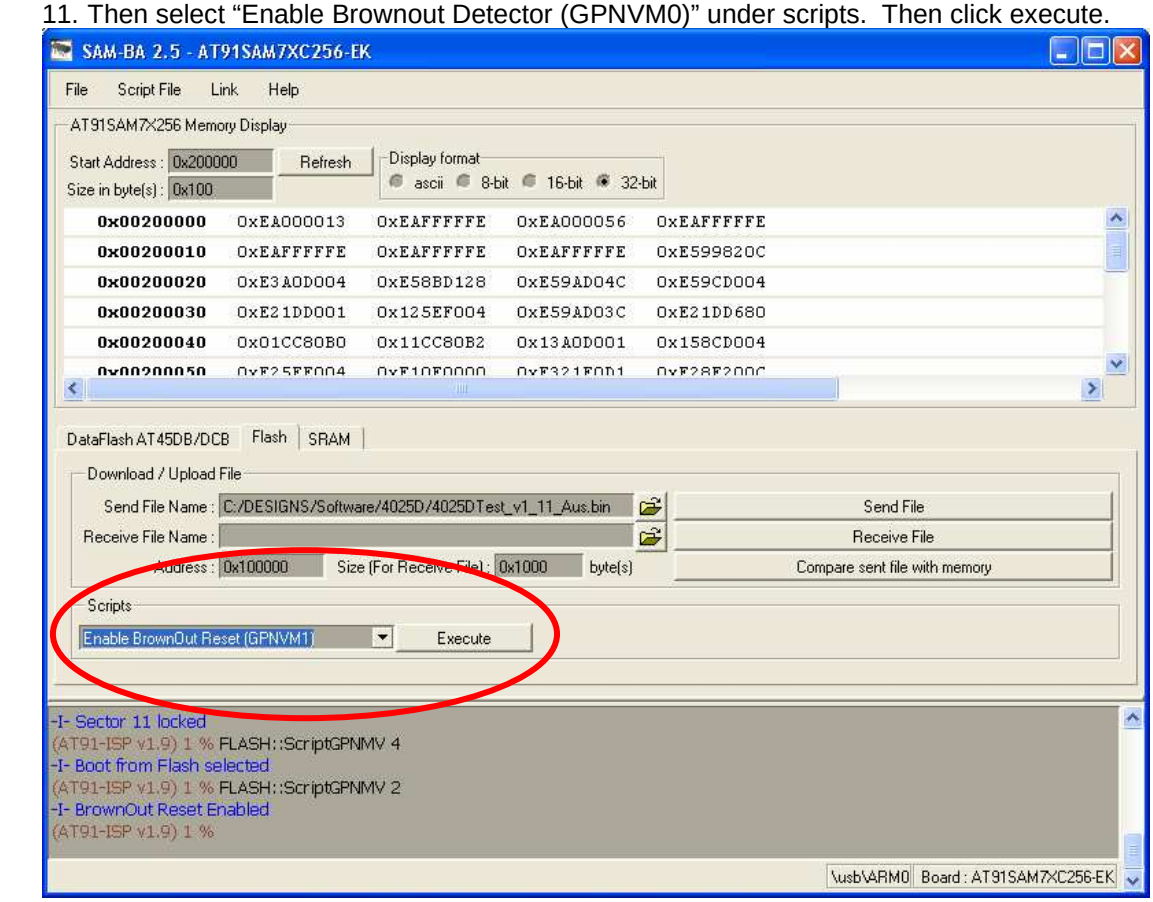
9. Then click on Yes to prompt screen below to lock the flash region(s).



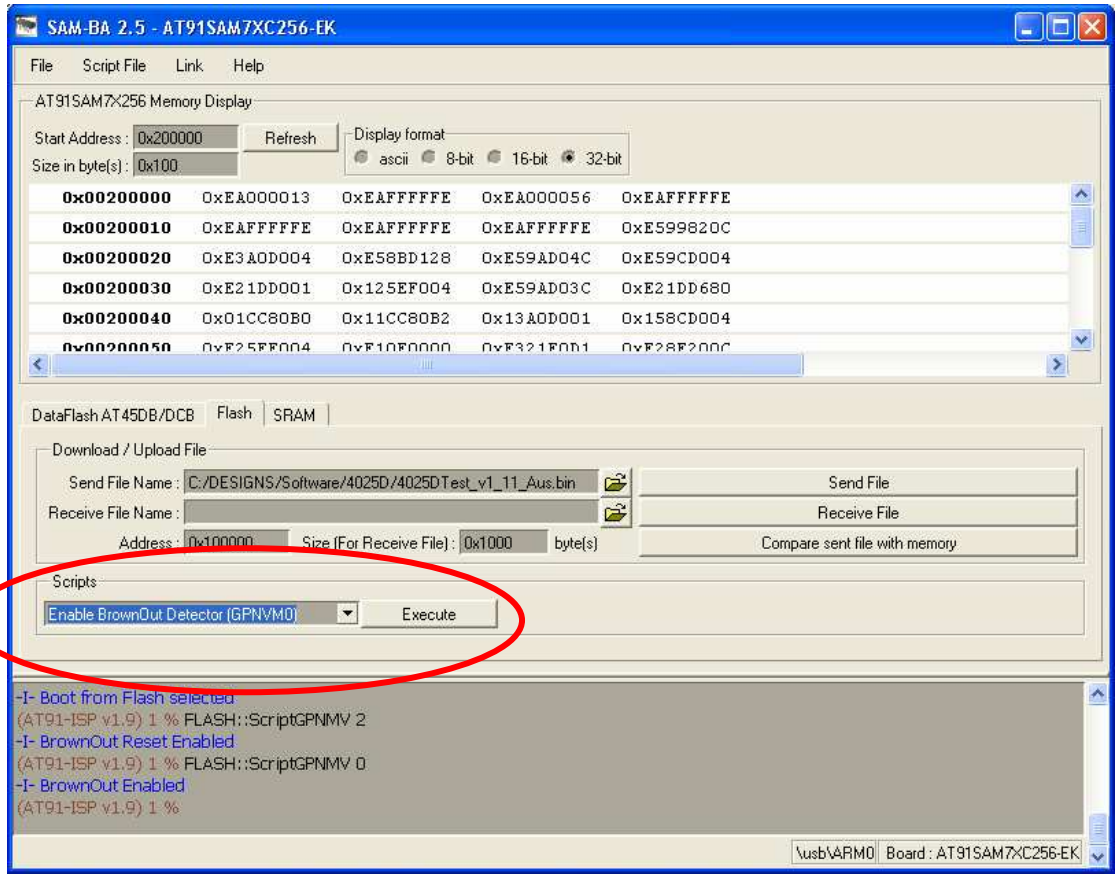
10. Select “Boot from Flash (GPNVM2)” under scripts. Then click execute.



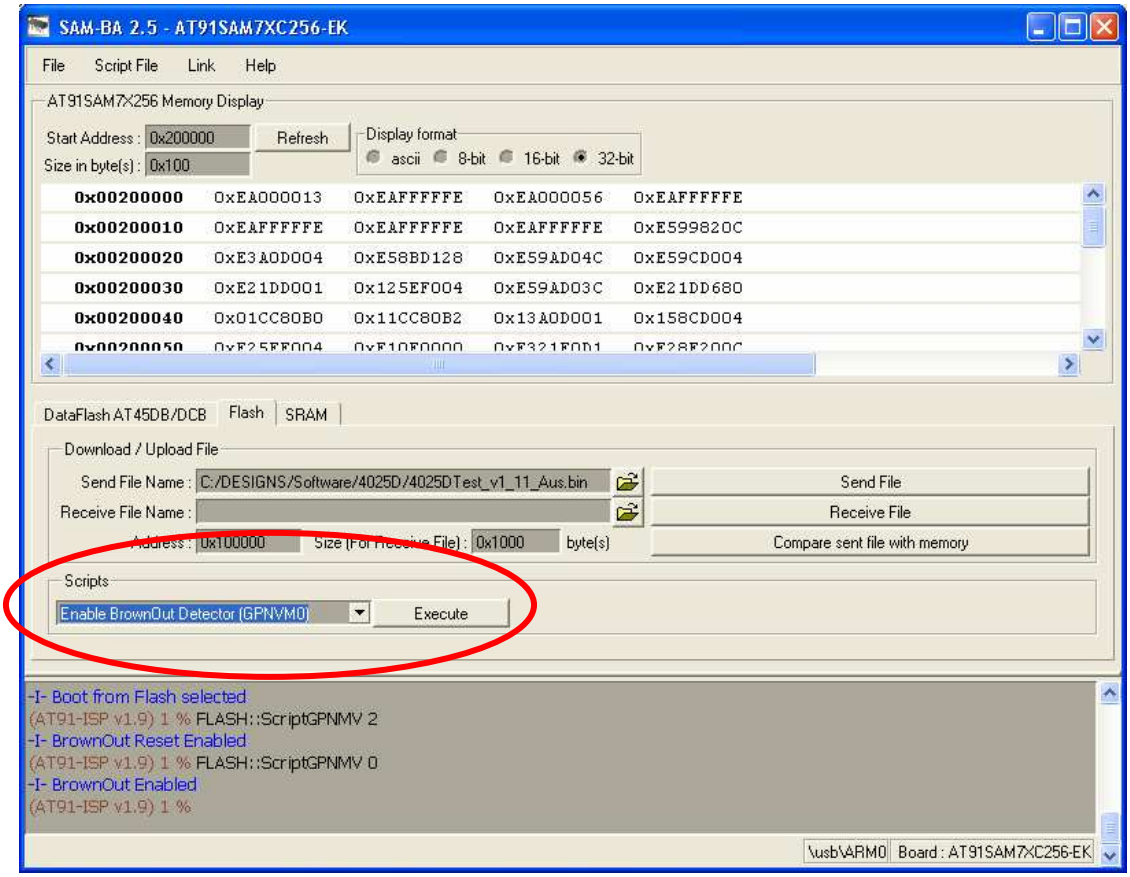
11. Then select “Enable Brownout Detector (GPNVM0)” under scripts. Then click execute.



12. Then select “Enable BrownOut Reset (GPNVM1)” under scripts. Then click execute to force this setting.



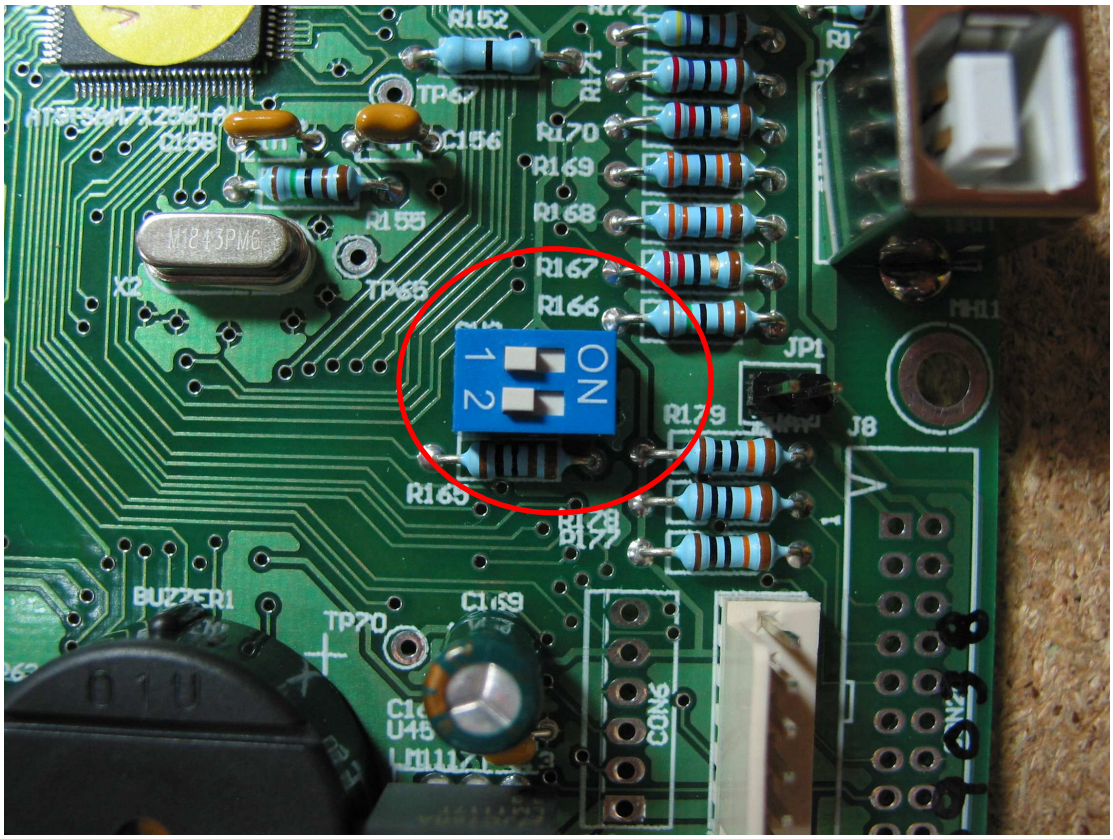
13. Then select “Enable Security Bit” under scripts. Then click Execute to perform this operation.



7.7 Restore Dip switches Settings & Restart instrument

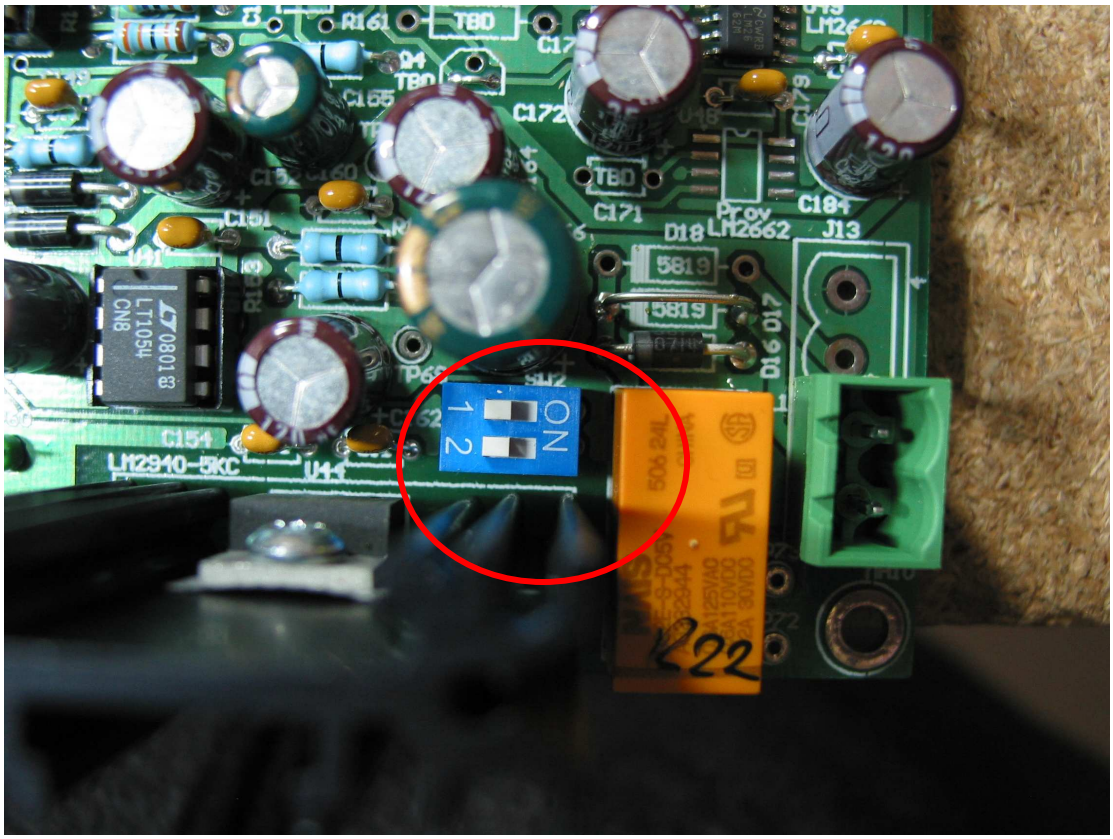
1. After the firmware has been updated, quit SAM-BA application.
2. Disconnect the USB cable from PC.
3. Make sure the Erase switch SW3 is in OFF position as per original factory setting. Refer to Photo 4 below.

Photo 4. Erase switch OFF/disabled (factory setting).



4. Next, make sure POWER dip switch is restored to OFF position as per original factory setting. Refer to Photo 5. Doing so will switch off instrument. This should happen.

Photo 5. Power switch OFF (factory setting).



5. Close instrument lid again. Switch ON instrument using the ON button on the front panel.
6. Check and confirm the software version number in the startup message on the LCD to ensure software has been updated to the latest version.
7. Next, put instrument back into its pelican case. Ensure all screws are put back in place and tightened properly.

7.8 Troubleshooting firmware updates

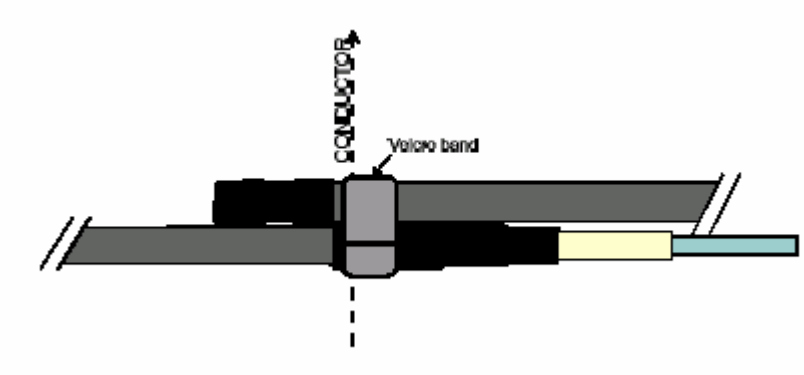
1. If you get a blank LCD screen after completing the above steps, check that SW3 has been restored to original setting. Otherwise, software would have been erased again when instrument was switched back on. If that is the case, repeat the whole procedure again.
2. If you cannot turn instrument off again, check that SW2 has been restored to factory setting. If not, instrument cannot turn itself off automatically nor be turned off via the OFF switch.

8. Appendix: ROGOWSKI COIL

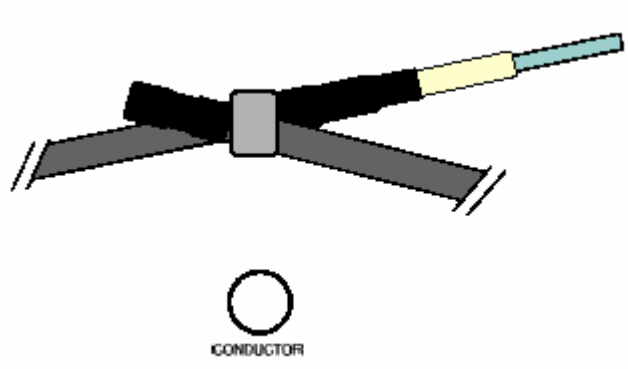
FEATURES:
Accuracy better than 1%
Good rejection of external magnetic fields
Low sensitivity to the position of the coil within the conductor.
Two-layer insulation.

INSTALLATION:
The coil is fitted by wrapping it round the conductor to be measured and bringing the ends together. The ends are fitted with a locating system to ensure that they are aligned correctly.
It is not recommended that coils are installed on uninsulated conductors that can carry dangerous voltages.

Electrical connection to the coil is at one end only. The other end is 'free' to be threaded round awkwardly-shaped conductors or conductors in confined spaces.



The correct method for aligning the ends is shown in the figure above. The two black ends should overlap and are held in place with the Velcro® strap.



With short coils it is difficult to get the ends accurately parallel. If they end up looking like the second diagram the accuracy is not significantly affected provided they are initially aligned as shown in the top diagram.
If the ends are not properly aligned, this will result in a measurement error. The error is equal to the degree of misalignment divided by the length of the coil. For example, with a 500mm coil a misalignment of 5mm will result in a

1% error. Misalignment of the ends also makes the coil more prone to interference from other conductors which are carrying a current close to the coil.

It is not necessary to mount the coil so that it is circular nor is it necessary to have the conductor exactly in the centre of the loop. Off-centre operation does not normally introduce errors of more than I - 2%. If the coil is long enough it can be wrapped more than once round the conductor provided the ends are brought together correctly. The Amps readout on the Model 4025 should then be divided by the number of wraps.

CALIBRATION:
The coils are fitted with a 'Robinson Box'. This has a trimming resistor that is pre-calibrated at the factory. The Model 4025 calibration is performed with a specific coil. For best accuracy it is recommended that the coils not be interchanged

CONNECTIONS:
The coils are connected to the Robinson Box by a 'twinax' cable (twisted pair with overall screen) which is permanently attached to the coil. The standard lead length is 2m . Another 2m output lead with a LEMO plug at the end is permanently attached to the box and this can be plugged directly into the Model 4025.

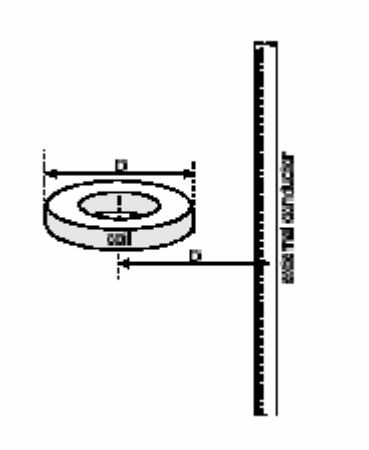
SCREENING:
All Type 545 coils are fitted with an electrostatic screen. The screen is insulated from the winding and is connected to the shell of the LEMO connector.

INSULATION:
Coils are insulated in a single layer of polyolefin sleeve (UL E35586, AMS-DTL-23053/4 Class 3) with an outer layer of Polyester braid. This is the same system as used with the original Robinson coils except that the originals had a grey outer layer instead of black. The outer layer of insulation has an attractive finish and provides mechanical protection. However this insulation is not recommended for use on uninsulated conductors which carry dangerous voltages unless additional insulation is provided.

SURGE PROTECTION:
The Robinson Box is fitted with Gas Discharge Tubes (GDT) to protect the input of the integrator from high-voltage surges.

TEMPERATURE RATING:
These coils have not been tested for use at elevated temperatures. However it is suggested that operation at ambient temperatures higher than 80℃ should be avoided.
At high temperatures some of the materials used in the construction will soften and for prolonged exposure it may be advisable to provide additional support for the coil.
The polyester braid may be damaged if it comes into contact with hot surfaces

INFLUENCE OF EXTERNAL MAGNETIC FIELDS:
The pick-up from an external conductor is used as a quality check and all coils are tested. The coil is usually placed a distance of one diameter away from the conductor as shown in the figure. When the plane of the coil is perpendicular to the external conductor, as shown in the figure, the pick-up is less than 1%.



If the plane of the coil is parallel to the external conductor the pickup may be more than 1% especially if the join in the coil is close to the external conductor.

INFLUENCE OF CONDUCTOR POSITION:
If the conductor is moved from the central position by a distance equal to 0.5 x the coil radius the output will change by less than 1%.

COIL LENGTH:
A coil length of 3m is supplied as standard

9. Appendix: FLUKE i3000s - 24 AC CURRENT PROBE

FLUKE®

i3000s/i2000 Flex

AC Current Probe

Instruction Sheet

Introduction

The i3000s 24 Flex, i3000s 36 Flex, and i2000 Flex AC Current Probes (hereafter referred to as "the Probe") are used with oscilloscopes, digital multimeters, recorders or data loggers. The i3000s probes can be used to measure AC current up to 3000 A. The i2000 can be used to measure AC current up to 2000 A. The flexible measuring head allows current measurements on conductors that are hard to reach or inaccessible using typical clamp-on current probes.

The Probes provide a low-voltage (3 V AC for i3000s models, and 2 V AC for i2000) output that is proportional to the current being measured. The Probes provide full-scale direct readings for 30 A, 300 A, and 3000 A when using the i3000s models, and 20 A, 200 A, and 2000 A when using the i2000.

Symbols

The following table shows the symbols used on the product and/or in this manual.

Symbol	Description
	Do not dispose of this product as unsorted municipal waste. Contact Fluke or a qualified recycler for disposal.
	Important Information. Refer to the manual.
	Double/Reinforced insulation.
	Do not apply around or remove from the HAZARDOUS LIVE conductors.
CE	Complies with the relevant European standards.
c UL us	Conforms to Underwriters' Laboratory, Inc.

Safety Instructions

In this instruction sheet, a **Warning** identifies conditions and actions that pose hazard(s) to the user. A **Caution** identifies conditions and actions that may damage the calibrator or the test instruments.

⚠⚠ Warning

To avoid electric shock or personal injury:

- **Use the Probes only if qualified.**
- **Use caution during installation and use of the Probe; high voltages and currents may be present in circuit under test.**
- **Have maintenance performed by only qualified service personnel.**
- **Protect the probe against water and humidity.**
- **Wear protective clothing and gloves as required.**
- **Do not install this product on live conductors. Always de-energize the circuit under test before installing the flexible measuring head.**
- **Always inspect the electronics unit, connecting cable, and flexible measuring head for damage before using the Probe.**
- **Do not use the Probe if damaged.**
- **Always connect Probe to display device before installing the flexible measuring head.**
- **Never change batteries while measurement head is installed on conductor.**
- **Never connect or disconnect the external power supply while the measurement head is installed on a conductor.**
- **Use only the provided original or specified accessories.**
- **Use the Current Probe only as specified in the operating instructions; otherwise the current probe's safety features may not protect you.**

- **Adhere to local and national safety codes. Individual protective equipment must be used to prevent shock and arc blast injury where hazardous live conductors are exposed.**
- **CAT III equipment is designed to protect against the transients in the equipment in fixed equipment installations, such as distribution panels, feeders and short branch circuits, and the lighting systems in large buildings.**

Specifications

Electrical Characteristics

Measuring ranges	
i3000s (24 and 36 Flex)	30 A/300 A/3000 A AC, switch selectable
i2000 Flex	20 A/200 A/2000 A AC, switch selectable
Output sensitivity	100 mV/10 mV/1 mV per A (AC coupled)
Accuracy (at 25 °C)	±1 % of range (45 – 65 Hz)
Frequency range	
i3000s (24 and 36 Flex)	10 Hz to 50 kHz (-3 dB)
i2000 Flex	10 Hz to 20 kHz (-1 dB)
Phase error	< ±1° (45 – 65 Hz), ±10° (at 20 kHz)
Linearity	±0.2 % of reading from 10 % - 100 % of range
Position sensitivity	±2 % of range with cable >25 mm (1") from the coupling
External field	±1 % of range with cable >200 mm (8 in) from the head
Minimum load	100 kΩ for specified accuracy
Noise	8 mV RMS (0.3 % of range) in 30 A range
	2 mV RMS (0.1 % of range) in 300 A and 3000 A
Gain variation	±0.08 %/°C
Operating temperature	
i3000s (24 and 36 Flex)	-20 to +85 °C (-4 to 185 °F)
i2000 Flex	0 to 70 °C (32 to 158 °F)
Storage temperature	
i3000s (24 and 36 Flex)	-20 to +85 °C (-4 to 185 °F)
i2000 Flex	0 to 70 °C (32 to 158 °F)
Temperature coefficient:	± 0.08 % of reading / °C
Operating humidity:	15 to 85 % (non condensing)C
Altitude:	2000 m
Power supply	Two AA NEDA15A, MN1500, IEC LR6 alkaline batteries (all probes)
	Or an optional Class II external power supply (+3 V) (i3000 and i3000s)
Battery life	
i3000s (24 and 36 Flex)	400 hours typical
i2000 Flex	200 hours typical
Low battery	Indicated by a red LED

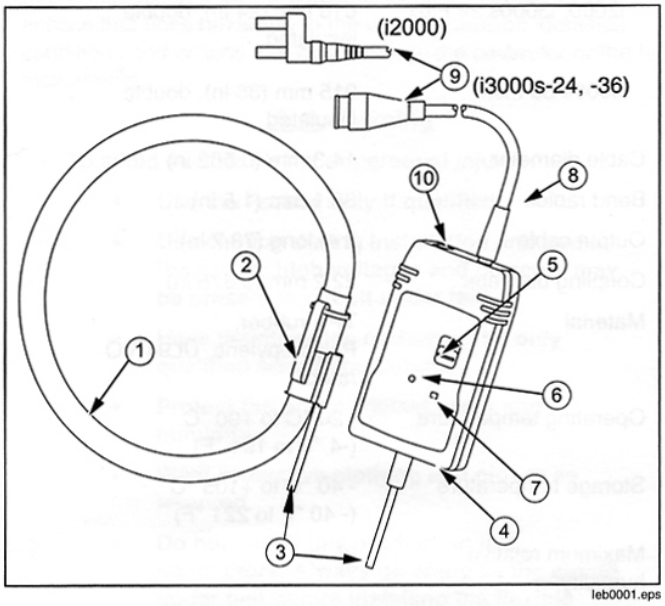
General Characteristics

Enclosure	IP5X flame retardant UL94-VO rated
Material	Valox 357
Output con.	
i3000s (24 and 36 Flex)	Coaxial cable with a male safety BNC connector. BNC to Banana plug adaptor (supplied)
i2000 Flex	0.5 meter cable with 4 mm safety plugs
Weight	0.19 kg (0.4 lb)
Safety	BS EN 61010-1, 600 V CAT III Pol. Deg 2
EMC	BS EN 61326
Dimensions	116 (l) x 68.5 (w) x 30 (d) mm
	4.57 (l) x 2.71 (w) x 1.18 (d) in

Measuring Head Characteristics

Cable length	
i2000, i3000s 24 Flex	610 mm (24 in), double insulated
i3000s 36 Flex	915 mm (36 in), double insulated
Cable diameter	14.3 mm (0.562 in)
Bend radius	38.1 mm (1.5 in)
Output cable	2 m long (78.7 in)
Coupling diameter	22.2 mm (0.875 in)
Material	TPE rubber, Polypropylene, UL94-VO rated
Operating temperature	- 20 °C to +90 °C (-4 °F to 194 °F)
Storage temperature	- 40 °C to +105 °C (- 40 °F to 221 °F)
Maximum relative humidity	85 %
Weight	0.18 kg (0.4 lb.)
Safety	BS EN 61010-1, 600 V CAT III Pol. Deg 2

Operating Instructions



① Measuring head

② Measuring head coupling

③ Head output cable

④ Enclosure

⑤ Power on/Range selector

⑥ Battery low indicator

⑦ Power on indicator

⑧ Output cable

⑨ Safety BNC connector

⑩ External power supply input

Battery Installation

⚠⚠Warning

To avoid electric shock or personal injury:

- **Never replace batteries with the flexible measuring head installed on the conductor to be tested or with the output connected to a display device.**
- **Never operate the unit without the battery cover installed.**

The Probes require two AA/MN1500/LR6 alkaline batteries for operation. The battery compartment is accessed from the rear end of the electronic enclosure.

The batteries must be replaced when the LED is lit continuously or when it fails to light up. Ensure that the Probe is away from any current carrying conductor and also that the output is disconnected from other equipment.

To install the battery:

1. Use a coin or a similar tool to turn the battery lock (¼ turn) until the dot aligns with the unlock symbol.
2. Remove the battery cover.
3. Install the batteries ensuring that correct polarity is observed.
4. Replace the battery cover and turn the battery lock until the dot aligns with the lock symbol.

External Power Supply (i3000s Models)

An optional Class II external power supply is available from Fluke. The power supply is designed to ensure that the Probe continues to meet its specified safety standards. The usage of a power supply from another vendor is not recommended.

⚠⚠Warning

To avoid electric shock or injury, never connect or disconnect the external power supply with the flexible measuring head installed on the conductor or with the output connected to a display device.

Measuring Current

⚠⚠Warning

- **To avoid electric shock or injury, read Safety Instructions before operating this product**
- **Ensure that the conductor to be tested is de-energized**

To measure current:

1. Connect the output of the electronics to the input of an oscilloscope or other data recording device.

⚠⚠Warning

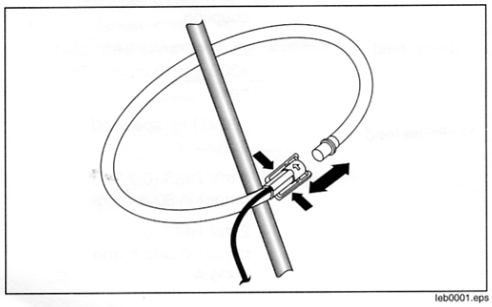
To avoid electric shock or injury, the flexible current probe is not for use on conductors with a potential of over 600 V.

2. Wrap the flexible measuring head around the conductor to be tested in a close coupling manner.
3. Energize the circuit under test.
4. For most accurate measurement, centre the flexible head around the conductor.
5. Locate coupling away from the nearby conductors.

⚠⚠ Warning

To avoid electric shock or injury:

- **Do not use the flexible current probe to measure bare conductors unless wearing protective clothing suitable for high voltage work.**
- **Always use appropriate equipment for personal protection. When installed on bare conductors/busbars, the product must be within a suitable enclosure.**



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Operation

To activate the unit, move the switch from 'Off' position to the required measuring range. If the value of current being measured is unknown, select the 3000 A (i3000s models) or 2000 A (i2000) current range and then reduce accordingly.

Battery Status

Battery status is indicated by an LED on the front of the probe. This LED will flash one time when the unit is activated. The length of time the LED is lit will increase as battery life decreases. Momentary lighting of LED indicates batteries are good. Continuous lighting of LED indicates low battery and requires replacement at the earliest. No lighting of LED indicates batteries are dead and require replacement immediately.

Maintenance

⚠⚠ Warning

To avoid electric shock or injury, do not use Probe if damaged.

Always inspect the electronics unit, connecting cable, and flexible measuring head for damage before use.

To avoid electric shock, keep the probes clean and free of surface contamination. Use Isopropyl alcohol to clean the electronics unit and measuring head. Make sure that the flexible measuring head, connecting cable, and electronic enclosure are dry before further use.

LIMITED WARRANTY AND LIMITATION OF LIABILITY

This Fluke product will be free from defects in material and workmanship for one year from the date of purchase. This warranty does not cover fuses, disposable batteries, or damage from accident, neglect, misuse, alteration, contamination, or abnormal conditions of operation or handling. Resellers are not authorized to extend any other warranty on Fluke's behalf. To obtain service during the warranty period, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that Service Center with a description of the problem.

THIS WARRANTY IS YOUR ONLY REMEDY. NO OTHER WARRANTIES, SUCH AS FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSED OR IMPLIED. FLUKE IS NOT LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM ANY CAUSE OR THEORY. Since some states or countries do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you.

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