VOLTECH INSTRUMENTS

AC Interface Fixture

User Manual

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Voltech Part Number: 98-072, Issue 8

DANGER OF ELECTRIC SHOCK

Only qualified personnel should install this equipment, after reading and understanding this user manual. If in doubt, consult your supplier.

Please consult the safety information section of this user manual before installation and use.

RISQUE D'ELECTROCUTION

L'installation de cet équipement ne doit être confiée qu'à un personnel qualifié ayant lu et compris le présent manuel d'utilisation. Dans le doute, s'adresser au fournisseur.

GEFAHR VON ELEKTRISCHEM SCHOCK

Nur entsprechend ausgebildetes Personal ist berechtigt, diese Ausrüstung nach dem Lesen und Verständnis dieses Anwendungshandbuches zu installieren. Falls Sie Zweifel haben sollten, wenden Sie sich bitte an Ihren Lieferanten.

RISCHIO DI SCARICHE ELETTRICHE

Solo personale qualificato può installare questo strumento, dopo la lettura e la comprensione di questo manuale. Se esistono dubbi consultate il vostro rivenditore.

Contents

1. Introduction

1. INTRODUCTION

Thank you for choosing to use this Voltech product.

If you experience any difficulty during installation or use of the Voltech AC Interface or are unsure of any of its features or abilities, please do not hesitate to contact either your local Voltech supplier or one of our Voltech main service centres.

1.1. FEATURES & ABILITIES

The Voltech AC Interface is a versatile, easy-to-use accessory for the Voltech AT3600/AT5600 transformer tester. The AC Interface:

- Extends the range of wound components that may be tested by the AT3600/AT5600 by allowing a variety of third-party AC sources to provide the test signal

- Can be used with either

    A simple step-up or step-down transformer for 0-600V , < 40 W

    External sources that provide up to 600V @ 10A, 20Hz to 5 kHz for testing higher power transformers.

- Automatically controls the AC source to optimise test speed and enhance operator safety.

- Integrates the AC source seamlessly into the AT3600/AT5600 environment and allows all other standard tests to be executed in the same program that is used by the external source.

- Fits into the rear part of the fixture bay on an AT3600/AT5600.

- Provides a convenient method of connection between the source, the AT3600/AT5600 and the test piece.

- Comes with all necessary inter-connecting leads supplied.

- Isolates the AT3600/AT5600 from the external source, when the external source is not being used, preventing damage to the source during later high-voltage testing.

- Allows a step-up or step-down transformer to be used to boost the voltage or current of the AT3600/AT5600's internal generator.

- Makes four tests available for use with the AT3600/AT5600 and an AC source:
    - MAGX - Magnetising Current (External Source)
    - VOCX - Open Circuit Voltage (External Source)
    - WATX - Wattage (External Source)
    - STRW - Stress Wattage (External Source)

1.2. PACKAGE CONTENTS

The following items are supplied with your AC interface. Please check that you have every item and report any missing items to your Voltech supplier as soon as possible.

Voltech AC Interface Fixture
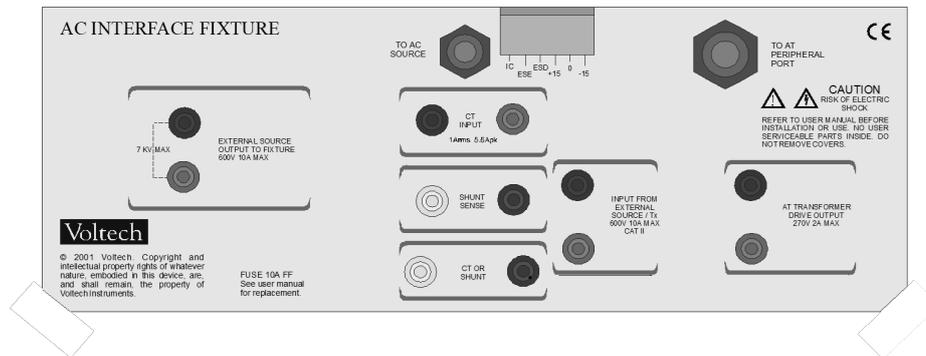
Kelvin clip leads, 10A rated (Voltech# 78-060)

For use during program design, or when the transformer does not have existing fixturing.

One black (Voltech# 78-067) and one red (Voltech# 78-068) 4mm safety to 4mm stackable AC test leads

For connecting the 'External Source Output' connectors of the Interface to the test fixture.

Two pairs of red (Voltech# 78-057) and black (Voltech# 78-058) 4mm safety to bare tinned leads.

One pair for connecting the external source or transformer secondary to the 'Input from External Source' connector of the AC Interface.

The other pair for connecting the 'AT Transformer Drive Output' to the primary of a transformer (if used).

One yellow 4mm and one blue 4mm safety socket.

For fitting to your existing test fixture to accept the leads from the 'External Source Output' of the AC Interface.

One current transformer CT 10-20 (Voltech# 31-132)

A precision current transformer that fits directly onto the AC Interface.
This is rated to 10 Amps AC RMS , with a ratio of 1:20 to step down the current so the AT can measure. This is the default ratio that is set when you configure the external source in the At Editor program.

Certificate of Conformance

1.3. CHOOSING AN AC SOURCE

To provide system reliability, integration with existing tests and operator safety, the Voltech AC Interface must be able to control the output of the external AC source that is being used with it.

The AC Interface allows two distinct types of AC sources to be used for testing:

- A power amplifier or an AC source configured as an Amplifier (analogue control)
- A voltage or current step-up transformer

A **power amplifier** is an AC source that can be configured so that its AC voltage output is a fixed multiple of a small AC voltage control input.

The output frequency of a power amplifier is the same as the input frequency of the small AC voltage control.

AC Control In

0 - 7.07 Vrms

(+/-10Vpk)

Power Amplifier

(x 50)

AC Power Out

0 - 250V @ 10A
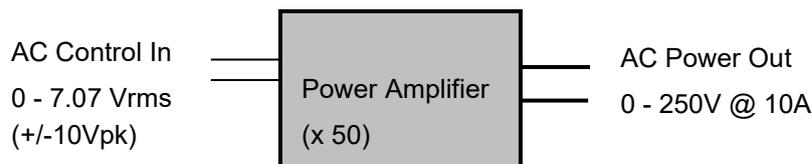
A power amplifier is Voltech's preferred choice of an external AC source to be used with the AT3600/AT5600 transformer tester and the AC Interface. Using a power amplifier, the AT3600/AT5600 will:

- Control the ramp-up and ramp-down of voltage to reduce settling time and optimise test speed.
- Control the ramp-up of voltage to reduce inrush current.
- Program any combination of voltage and frequency that the AC source can provide quickly and accurately. Different voltage / frequency combinations can be used within one program.
- Accurately trim to the desired output voltage to reduce errors due to the regulation of the source and the resistance of leads and connections.

Voltech recommends the following AC Sources.

1. **Chroma Model 61600 Series -** A low-cost AC Power Source solution.

- Voltage range: 0-150V/0-300V/Auto
- Frequency: 15Hz – 1000Hz
- Output power from 500VA to 4000VA, depends on model selected.
- For more details, please visit http://www.chromausa.com/product/low-power-programmable-ac-source-61600/

2. **Pacific Power ASX-115T Series** - A commonly available single-phase powered AC source that can provide 132V / 106 at 1500VA.

- Frequency: 15Hz - 1200Hz Direct, 45Hz – 1200Hz with output transformer
- It also has a built-in transformer mode, which allows up to 330V.
- For more details, please visit http://www.pacificpower.com/English/Products/ASX-Series.aspx

3. **Trek Model 2100HF** – A high-frequency, high speed wide bandwidth amplifier.

- Voltage range: 0 – 150Vpk, Output Current: 0 – 300mApk
- Frequency: 0 – 2.6MHz, Slew Rate: 2kV/us typical
- For more details, please visit http://www.trekinc.com/products/2100HF.asp

1.3.1 Worked Example of Chroma 61602
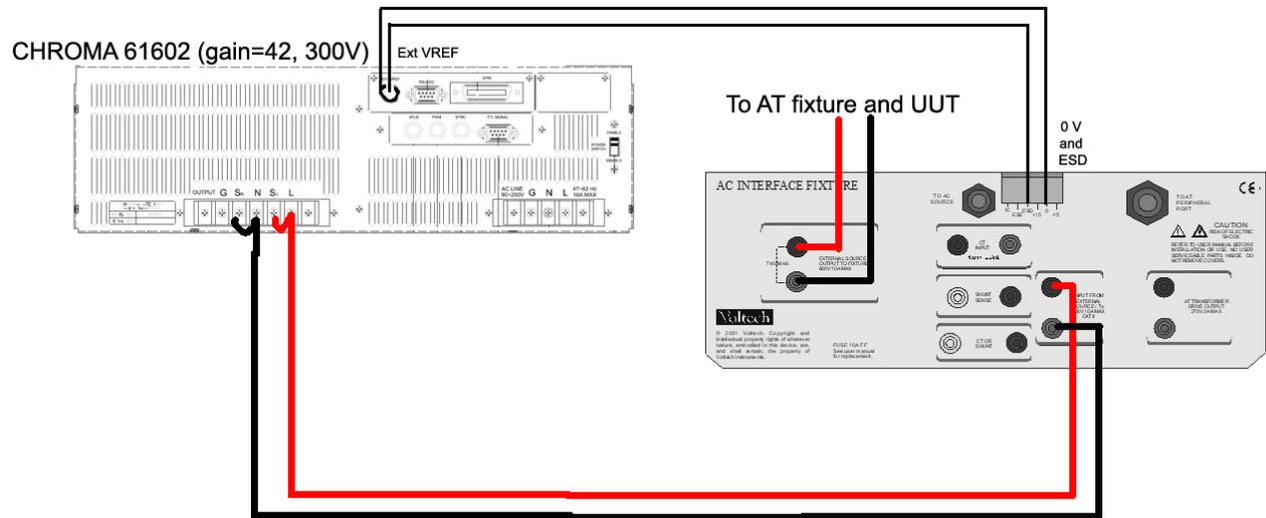
(CT10-20 module not shown fitted, but will be required)

1.3.2 AC Source and STEP-UP UP Transformer combined

Note: When using an Amplifier AND an additional external step-up transformer connected to the output of an Amplifier to increase the output voltage, a non-polarised capacitor must be wired in series with the output of the Amplifier and the drive of the step-up transformer due to offsets in the Amplifier which cannot be trimmed.
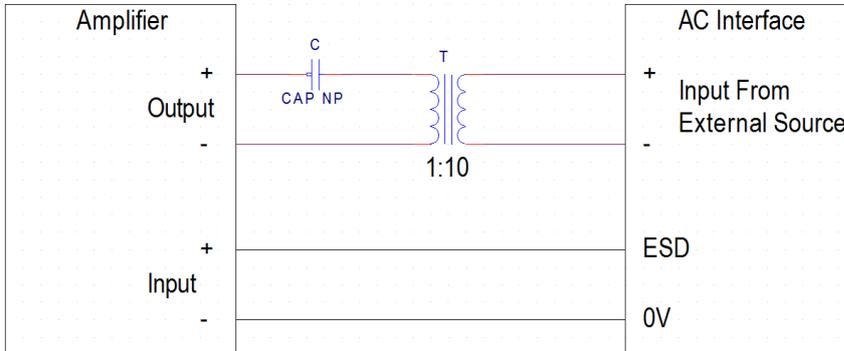
Selecting a capacitor:

C	$= (Im * N^2) / (2 * \pi * Fm * Vm * 10\%)$
$C_{VoltageRating}$	$= (2 * Vm * 10\%) / N$

Where:

C	is the Capacitor value (Farads)
$C_{VoltageRating}$	is the voltage rating of the capacitor (V)

Fm	is the test frequency (Hz)
Vm	is the measured voltage of the component under test (V)
Im	is the measured current of the component under test (A)
N	is the ratio of the step-up output transformer

Worked Example:

Using a 1:3 transformer connected to the output of an Amplifier and a Test parameter of

Vm = 440 V

Im = 80 mA

F = 50 Hz.

Find the series Capacitor needed.

C	$= (0.08 * 3 * 3) / (2 * 3.14 * 50 * 440 * 0.1)$	**= 52.11 uF**
$C_{VoltageRating}$	$= (2 * 440 * 0.1) / 3$	**= 29.3 Volts**

Therefore, a non-polarised capacitor with a value of around 50 uF and ≥ 30 V must be wired in series with the output of the Amplifier and the drive of the step-up transformer

1.3.3 Worked Example of Chroma 61602 + Chroma A615003

The same blocking capacitor is also needed , even if using off the shelf solutions.

Consider the below example of the Chroma 61602 Amp (0-300V) and the associated A615003 300-600V transformer accessory. In this case, the blocking capacitor is still needed

Using 50Hz, 500V, 0.3Amps, as test conditions, and 2:1 for the step-up ratio of the A615003, the capacitor need is 76uF, 50V

In this case we have used a general purpose, commonly available KEMET - R60EW61005000K 100 µF, ± 10%, 63 V Capacitor.

When writing the AT test program ATP file, a gain of 84 should be used for the external source set up, as this represents the entire system gain
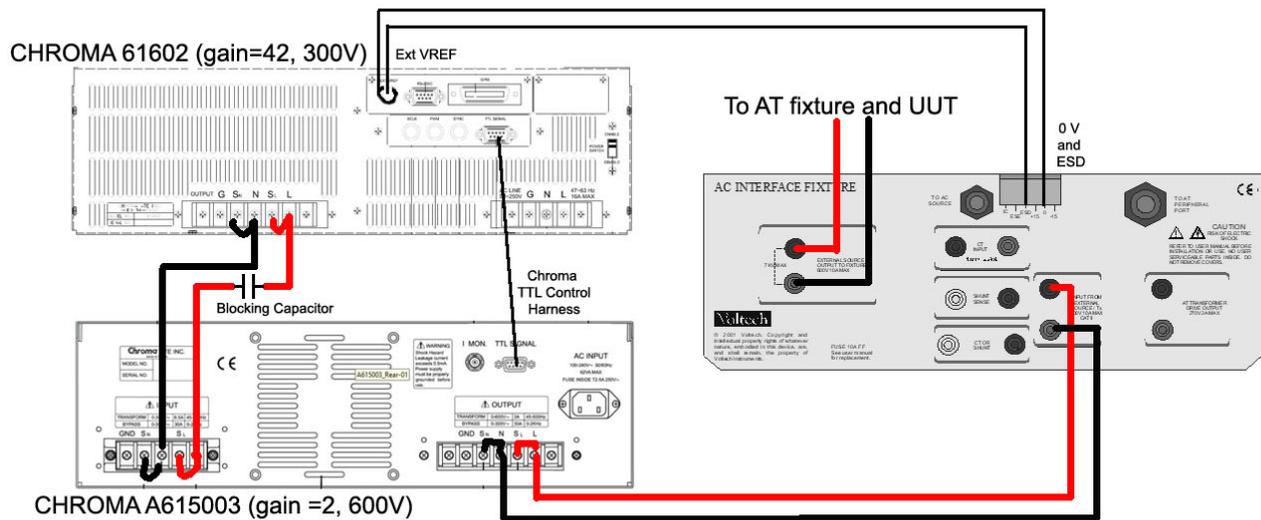
(CT10-20 module not shown fitted, but will be required)

1.4. CHOOSING STEP-UP OR STEP-DOWN TRANSFORMER

A **step-up or step-down transformer** can be used to boost the voltage or current of the AT5600's own internal 270V 2A 40 W AC source.

A step-up or step-down transformer provides good control but cannot boost the power available from the AT3600/AT5600. Using a good quality toroidal transformer, it may be possible to provide 540V @ 1A or 135V @ 4A, for example, but only at up to 40 W.

To give you most flexibility, and enough overhead on the step up, it is best to use a transformer with 1:3 or better step up. This means that when requesting the maximum 600 V AC output, the internal 270V AT56 supply will be only driven to 200 V AC into your chosen step-up transformer.

The AC Interface also contains blocking capacitors in this mode, to minimise any DC on the transformer input.

Please note that the programmed turn ratio on the AT Editor program should be roughly accurate but does not have to be exact, as the AT will constantly measure the applied output of the AC INTERFACE and constantly trim the input to the step-up transformer during the test to give your requested steady test conditions.

1.4.1 Tip: Using multiple step-up transformers

The simplest, easiest choice of step-up transformer is as above – a 1:3 transformer, with a 200 V rated primary, and 600 V rated secondary

However, if a 600V rated transformer is not available, it is also possible to use multiple step-up Transformers, with the primaries in parallel or series, and all the secondaries in series.

Again, the VA rating of each must be suitable (in both cases, the load will be shared across the transformers) , and you will not be able to generate more than the 40 Watts power from the AT56/AT36.

Ideally, you want to

A, drive the primaries from the AT36/56 class D (10-270V) at around 50-150 Volts, so that there is enough resolution for the unit control to trim he input to accurately give you the desired output

B, have 10% overhead on the output so that the step-up transformers you are using do not saturate – i.e., in the largest case, having a 660V capability where the max output ever requested would be 600V

C, Ensure the step-up transformers you use are suitable for the frequency you wish to generate.

Consider the two below examples of the two methods.

Primaries in Series, Secondaries in series
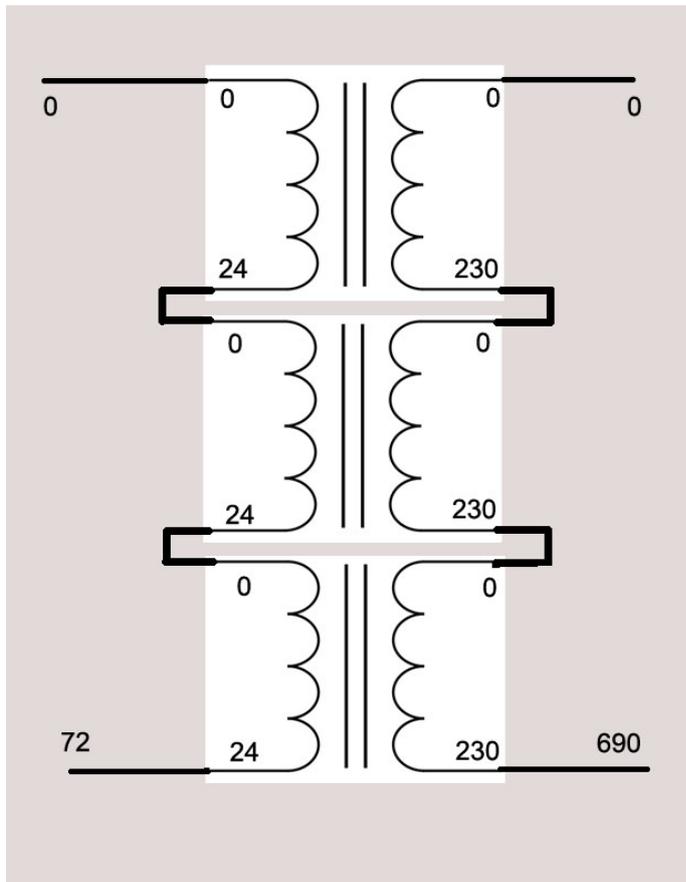
3 off 24 – 230 transformers were used.

The 3 x 24 V Primaries are in series, so that the input voltage would be comfortably above 50V, up to a max on 72 Volts

The 3 x 230 V secondaries are in series – giving 690V output

This can be considered (and programmed into the editor as "At output + Transformer) as a 72 – 690 V transformer with a gain of roughly 9.6

Each Transformer is 15 VA rated, so the whole step up is 45VA rated, so good for about 65 mA

Primaries in Parallel, Secondaries in series
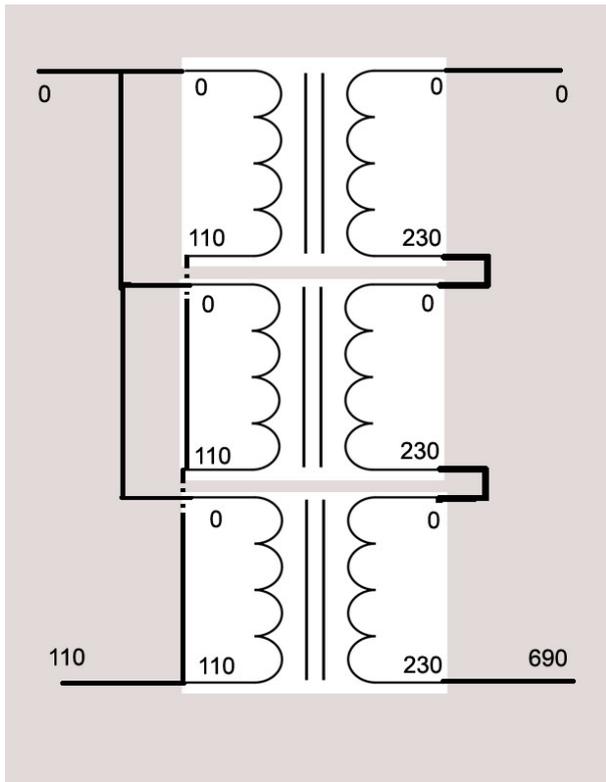
3 off 110 – 230 transformers were used.

The 3 x 110 V Primaries are in parallel, so that the input voltage would be comfortably above 50V, and with 110V max

The 3 x 230 V secondaries are in series – giving 690V output

This can be considered (and programmed into the editor as "At output + Transformer") as a 110 – 690 V transformer with a gain of roughly 6.3

Each Transformer is 15 VA rated, so the whole step up is 45VA rated, so good for about 65 mA

1.5. SUMMARY OF ADVANTAGES & DISADVANTAGES

Source Type	Advantages	Disadvantages
AC source configured as power amplifier	Simple in use; no set-up errors Controlled turn-on for reduced inrush current Trimmed output voltage Flexible voltage and frequency	Cost of the source
Output transformer	Simple in use; no set-up errors Controlled turn-on for reduced inrush current Trimmed output voltage Flexible voltage and frequency	Power limited to AT3600/AT5600 generator maximum (40 W)

1.6. OPERATING DESCRIPTION

The basic power circuit of the AC Interface provides connections on 4mm sockets for the output of the chosen source, a series current sensing device and output to the winding under test.
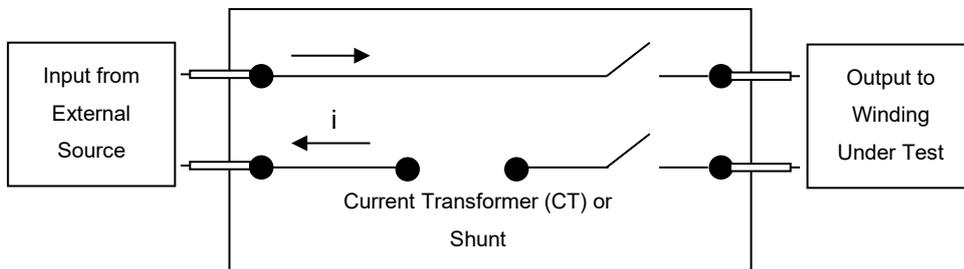
Test current flows from the external source into the fixture and out to the winding under test via an isolation relay.

The current returns through the fixture via another relay and a current sensing transformer or shunt that must be fitted to the interface.

A standard 1:20 current transformer is supplied with each interface which should be suitable for most applications.

The **'CT Input'** sockets on the fixture should be connected to the secondary of the current transformer, so that the AT3600/AT5600 can measure the current in the winding under test. When a resistive shunt is used, the 'Shunt Sense' sockets provide a voltage output that is proportional to the current. These terminals must be connected to nodes 17 and 19 of the AT3600/AT5600 if a resistive shunt is used.

The **'AT Transformer Drive Output'** sockets are used to drive a step-up or step-down transformer when that type of source has been chosen.

The cable fitted to the **'AT Peripheral Port'** gland must be fitted to the peripheral port of the AT3600/AT5600. This port supplies power and control signals to the AC Interface.

Control signals for an external source are available on the connecter next to the gland marked **'To AC Source.'**

Full details of each function are contained in the technical information section of this manual

2. INSTALLATION

2.1. GENERAL

1. Switch off the AT3600/AT5600 and remove any test fixtures.

2. Read and adhere to the safety information section of this manual.

3. Fit the AC Interface Fixture to the rear of the AT3600/AT5600's top platter and twist down the locking knobs.

4. Connect the lead 'To AT Peripheral Port' to the peripheral port of the AT3600/AT5600 at the rear of the tester.

5. Fit the desired current CT. Normally, you can just fit the supplied Voltech CT10-20 current transformer. For details, see the technical information section of this user manual.

2.2. POWER AMPLIFIER OR SOURCE WITH ON / OFF CONTROL

1. Switch off the power amplifier or AC source.
2. Connect the power output of the AC source to the sockets marked 'Input from External Source', using the red and black leads supplied. Observe the polarity of the connections. The source low should be connected to the black socket using the black lead.
3. Connect the control inputs of the AC source to their respective outputs from the interface via the 'To AC Source' connector. The ESE line is an enable or on / Off control; ESD is the AC control signal for the amplifier. At least one of these controls must be connected for this mode to operate without causing damage. See the technical information section of this manual for details.
4. Connect the 'External Source Output to Fixture' sockets to the test fixture using the red and black leads supplied. These are the leads that have 4mm plugs at each end.

Example Wiring: Power Amplifier or AC Source
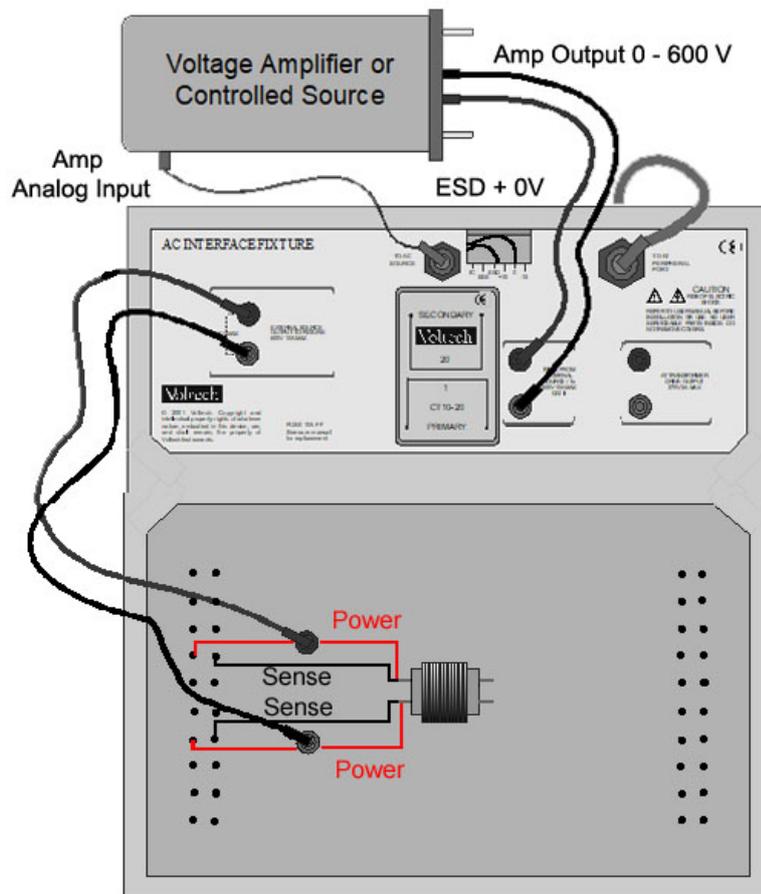
2.3. AT OUTPUT TRANSFORMER

1. Connect the primary of the transformer to the sockets marked 'AT Transformer Drive Output', using the red and black leads supplied.
2. Connect the secondary of the transformer to the sockets marked 'Input from External Source', using the red and black leads supplied.
3. Connect the 'External Source Output to Fixture' sockets to the test fixture, using the red and black leads supplied. These are the leads that have 4mm plugs at each end.
4. For operator safety the 'Output Transformer' +Leads must be ether: -

    a) Positioned within the Light Curtain safety enclosure.

    b) Positioned outside the Light Curtain safety enclosure, in metal earth-bonded housing, using High Voltage connecting leads.

Example Wiring: AT Output Transformer
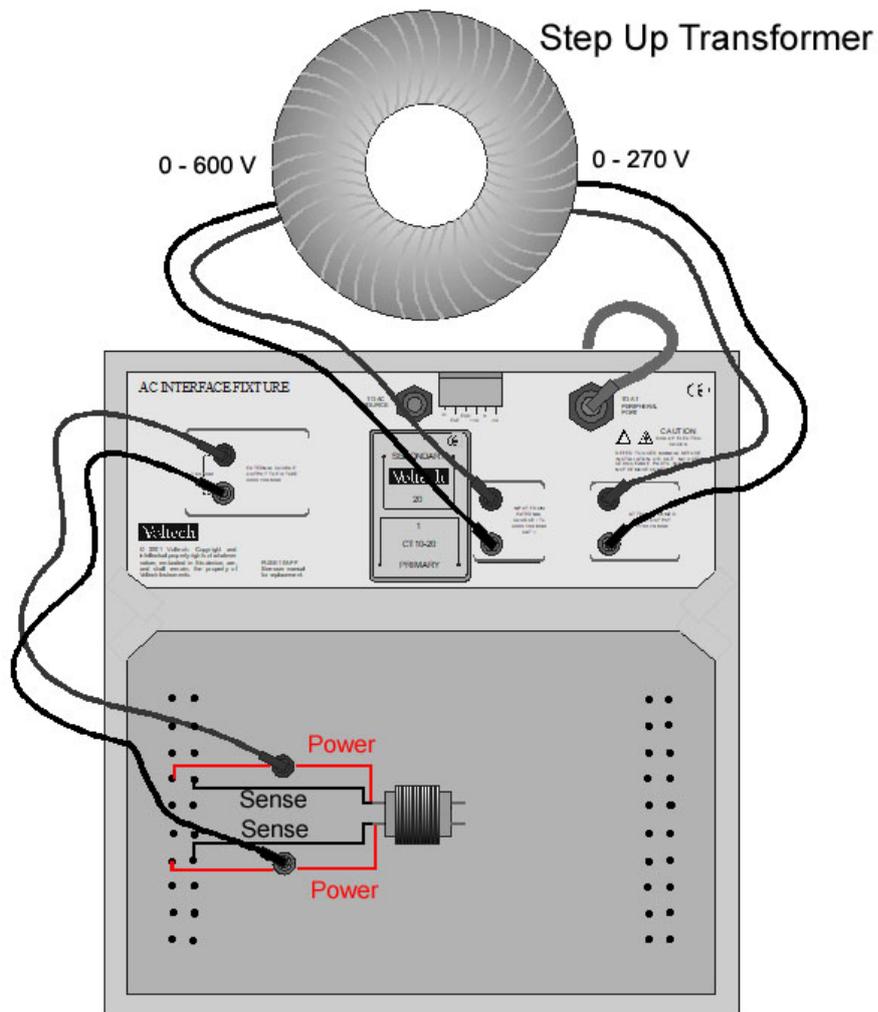
2.4. CONNECTIOSN TO THE TEST FIXTURE

When used with an AC Interface, the fixture requires the additional input of the test signal from 'External Source Output to Fixture' sockets of the AC Interface.

These connections will provide the power for testing. **Sense connections to nodes on the fixture must also be made**, so that the AT3600/AT5600 can measure and trim the voltage at the terminals of the winding under test.

The power connection will also be made to the same nodes, so that the AT3600/AT5600 can conduct tests that are stored in the same program but that do not use power from an external source, for example the more traditional R, LS RLS tests.

Once wired, the nodes can be selected for program use in the PC Editor.

[
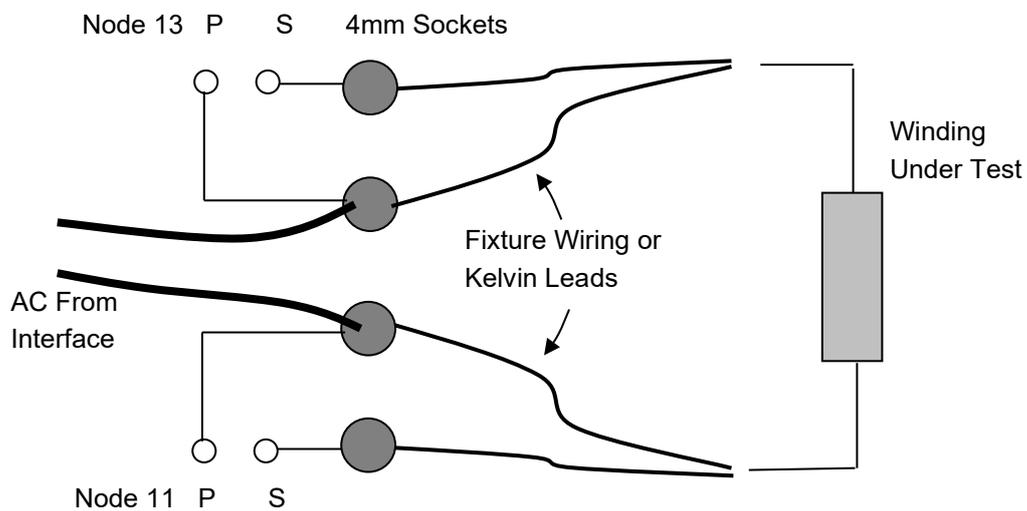
If you are using the universal fixture (# 91-186) , the AC Interface output leads can be stacked into the sockets on their required nodes

Below shows a simple step up with the AC interface connected to the power terminals on nodes 17+19 Kelvin leads are then used to connect to the unit under test.

Please remember that the **full signal path** should be rated for the Current and Voltage you expect.
In this case the 78-060 10A kelvin leads have been used.
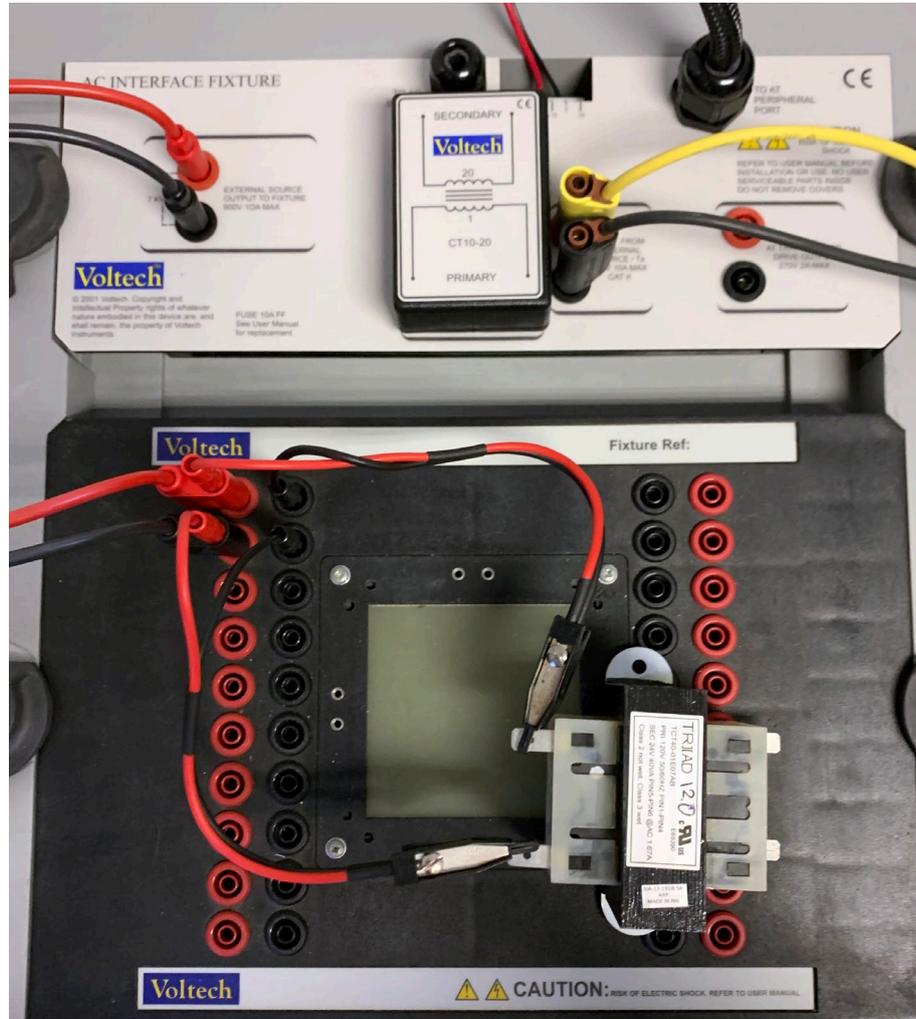
3. USING THE AT EDITOR SOFTWARE

Once you have connected your external AC source to the AT3600/AT5600 tester via the AC Interface, you will have to configure the test program in the PC Editor.

There are three steps to this configuration:

3.1 Configuration of the external AC source

3.2 Selection of the sense method

3.3 Selection of the external AC source in the PC Editor Program Options

3.1. CONFIGURATION OF EXTERNAL SOURCE IN AT EDIOTR

3.1.1 For A Step-Up Transformer

This source type is a transformer that may be used to boost the voltage or current that is produced by the internal high-power generator of the AT3600/AT5600.

For example, a transformer could be used to either step up the AT3600/AT5600's voltage or provide a higher current at lower voltages.

The benefits are that:

The AT3600/AT5600 will trim the output voltage during testing, so that the voltage across the test piece will always be at the programmed level, even if the gain of the source drifts or the impedances of the test parts are different.

The AT3600/AT5600 will ramp the test voltage up and down in a controlled manner, minimizing settling time and optimising test speed.

NOTE: Using a transformer in this way cannot boost the power available. This is limited to 40 Watts

Open the PC Editor and from the 'Setup' menu choose 'External Sources'.

Click on 'New' to configure a new external source.
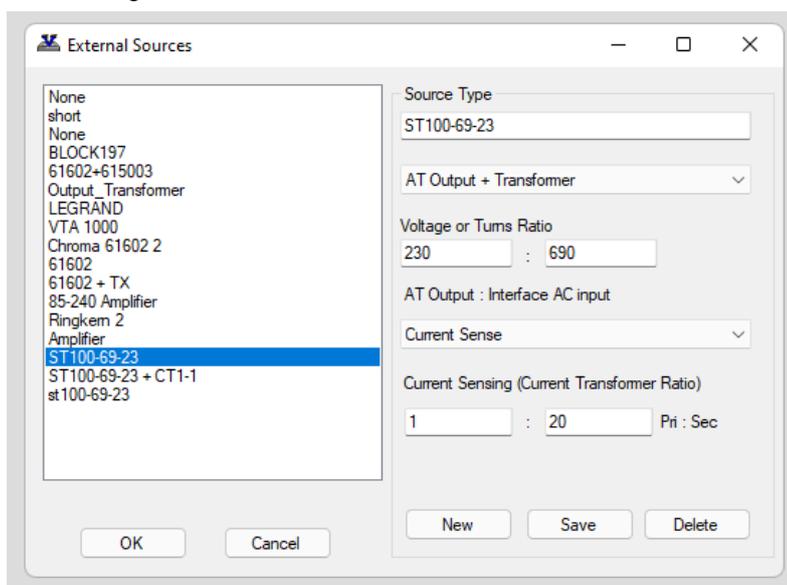
1, Enter a friendly name for your AC source in "Source Type"

2, From the 'Source Type' drop-down menu, select the appropriate source type = "AT Output + Transformer".

3, Set the voltage turns ratio of your transformer

The turns ratio in the editor program should be roughly accurate but does not have to be exact as the AT will constantly measure the applied output of the AC INTERFACE on the AT Test nodes it is connected to, and constantly trim the input to the step-up transformer during the test to give your requested steady test conditions.

You can either program a ratio (e.g., 1 : 3) , or the real primary and secondary voltages (e.g.,115:600). In all cases you should be sure that your chosen step-up transformer can supply the output voltages you will be requesting.
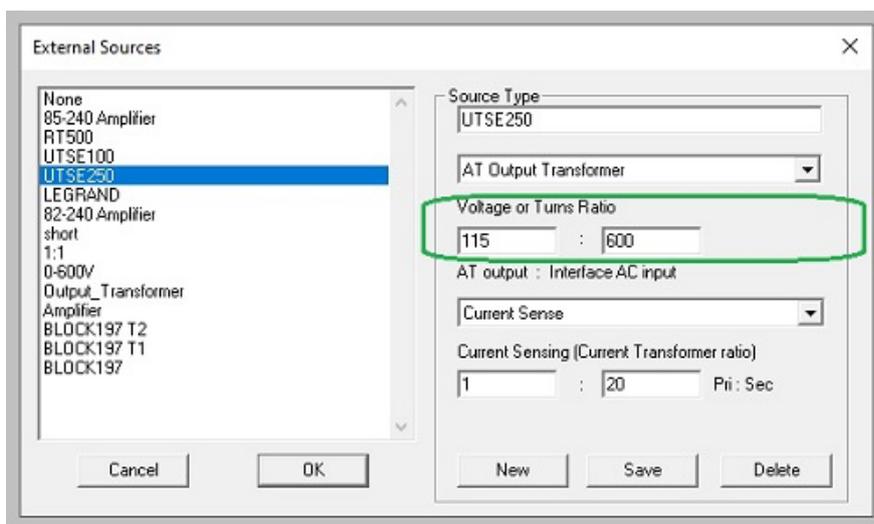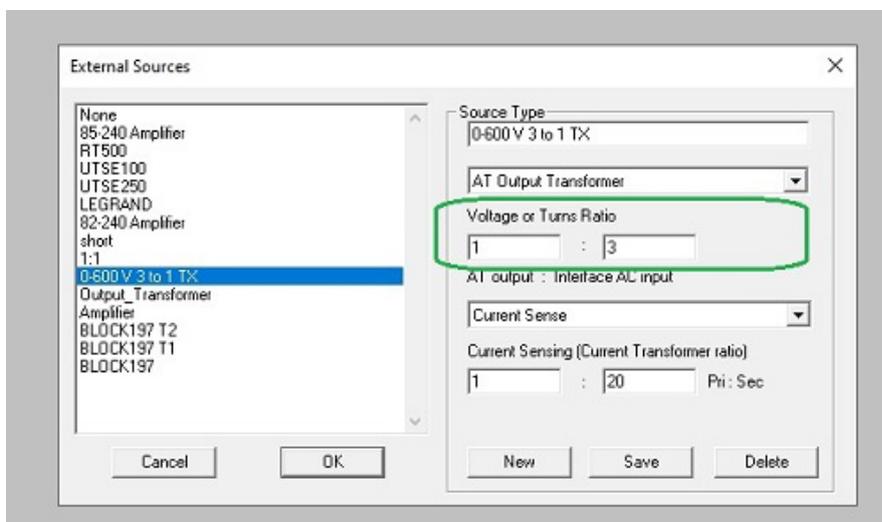
Note ; Once this is set up, you will program the tests (VOCX , MAGX , WATX STRX) in the normal way, and enter your requested voltage that you require on the UUT. The AT will then apply and trim the input voltage to the transformer to get your required test signal for your UUT

Click 'Save.' Your source now appears in the window on the left.

You can modify the configuration of an existing source by highlighting its name, modifying the configuration details, and clicking 'Save' again.

To delete a source, highlight its name, and click on 'Delete.'

Once you have configured your external AC source properly, click on 'OK' to save your set-up or choose 'Cancel' to discard any changes that you have made.

3.1.2 For An AC Source Amplifier / Analog Control

This source type is one that can function as power amplifier from a 5V RMS input.

Using this type of source gives the AT3600/AT5600 full control of the external source.

The benefits are that:

The AT3600/AT5600 will trim the output voltage during testing, so that the voltage across the test piece will always be at the programmed level, even if the gain of the source drifts or the impedances of the test parts are different.

The AT3600/AT5600 will ramp the test voltage up and down in a controlled manner, minimizing settling time and optimising test speed.

The Power can be over the 40 W limit of the Output Transformer method.

Open the PC Editor and from the 'Setup' menu choose 'External Sources'.
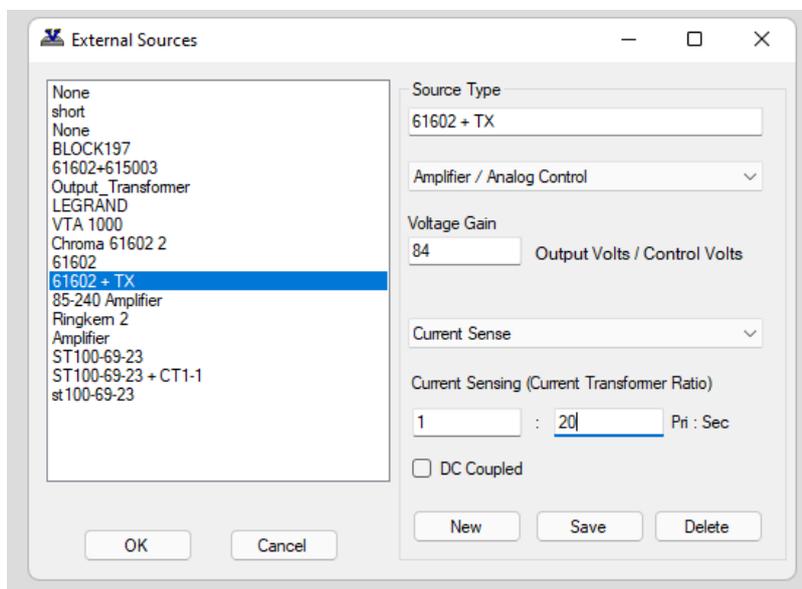
Click on 'New' to configure a new external source.

1 Enter your own choice of "friendly name" for your AC source in "Source Type"

2 From the 'Source Type' drop-down menu, select the appropriate source type = "Amplifier / Analog Control".

3 Set the voltage gain of your amplifier.

This defines the ratio of the input voltage from the ESD drive (0-5V RMS) to the output of the amplifier.

In the above example the gain is set to 84, i.e., that 1 V RMS must be supplied to the amplifier analog input, to generate 84 V RMS on the output

Note ; Once this is set up, you will program the tests (VOCX , MAGX , WATX STRX) in the normal way, and enter your requested voltage that you require on the UUT. The AT will then apply and trim the input voltage to the amplifier, based on your programmed gain, to get your required test signal for your UUT

Click 'Save.' Your source now appears in the window on the left.

You can modify the configuration of an existing source by highlighting its name, modifying the configuration details, and clicking 'Save' again.

IMPORTANT

If you are using an Amplifier AND a step-up transformer together (see 1.3.1) then this gain must be the gain of **the entire system.**

For example

The CHROMA 61620 Amp has a gain of 42, .

Max output is 300 V RMS

The CHROMA 61602 Amp + CHROMA 300-600V Transformer A615003 has a combined gain of 84, Maximum output is 600 V RMS

See section 1.3.2

3.2. CURRENT SENSE METHOD

The AC Interface measures current by using a current sense method.

The current is measured via a current transformer, which is fitted to the AC Interface.

You may enter the current transformer ratio into the dialogue box, so that the AT3600/AT5600 will report the correctly scaled current.

The CT10-20 plug in module supplied with your AC Interface has a ratio of 1 primary turn to 20 secondary turns (1:20).

The "10" represent the 10 Amps max that the primary (UTT) current can carry

The "20" represents the ratio of the CT transformer. This CT will scale these larger currents down (e.g., 5 Amps to 0.250 Amps) so that the AT can measure it.

Once this ratio is set, you program the test and limits in the real UUT current – the Editor and AT will manipulate the results to give a true UUT current.

Most customers will use the supplied CT10:20 plug in module, so the default settings of 1: 20 should be used. Users should be aware that this means smaller real currents on your UUT (<50ma) will also be scaled down x 20 so results will be more subject to noise floor.
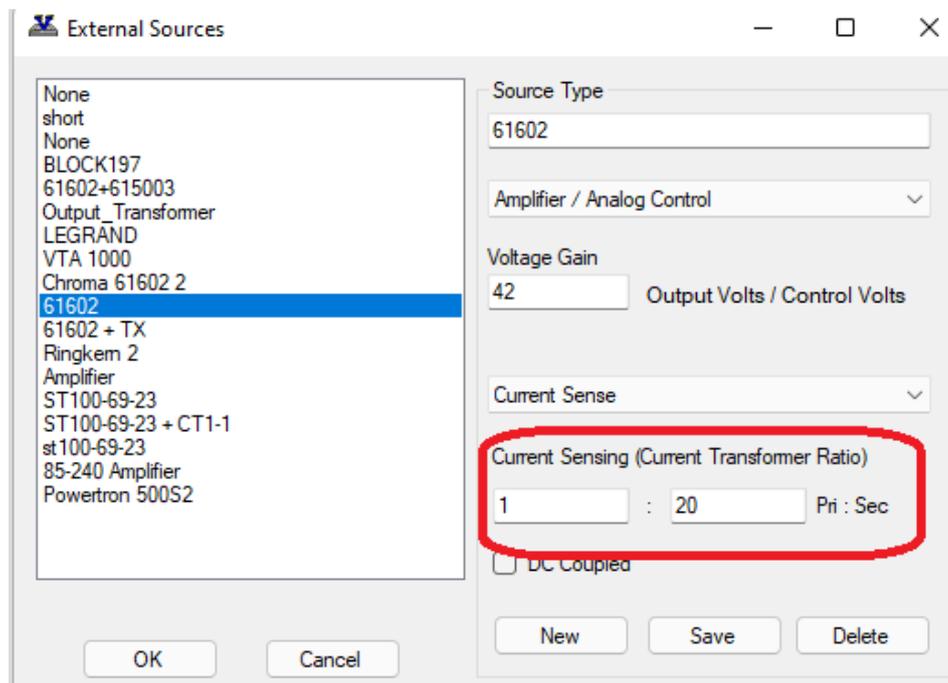
Current sense is much preferred over a voltage sense method, as the current sense method is much more accurate and more robust in an industrial environment.

Voltage sense methods are typically more susceptible to environmental electromagnetic noise.

3.3. SELECTION OF EXTERNAL AC SOURCE IN PC EDITOR

Finally, before you can use your external AC source with the PC Editor test program, you must select the source that you have configured in the Editor program options.

From the 'Program' menu, choose 'Options,' and from the 'External AC Source' drop-down menu, choose the source that you want to use for external AC source tests. (MAGX VOCX WATX STRX)
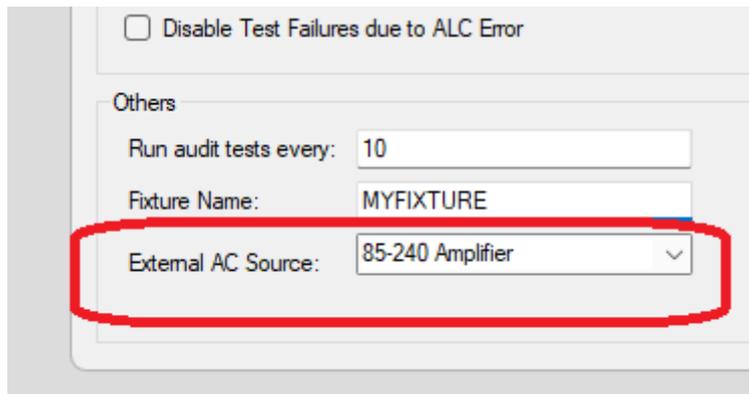
3.4. TESTING THE COMPLETE SYSTEM

To ensure that your complete test system provides operator safety and protects all components (including the AT3600/AT5600) from damage, it is vital that all source control methods that you have used are working properly.

Ensure that all connections are made as specified in this manual.

Test your safety interlock system.

To avoid damage from switch-on transients, switch on the AT3600/AT5600 first., Then switch on the AC source (if used).

1 Do not fit a test part at this stage. We are going to perform an open circuit test on two nodes to confirm that requested voltages are applied as a simple test of the set up.

2 Connect the ACIF output to two nodes – in this example we have used node 17 LO and node 19 HI

3 Write an AT Editor program, with one winding, on nodes 17+19

4, Add a VOCX test, with the same 19/A and 17/B nodes used for BOTH Energised and Measured terminals

In this example we have programmed a sequence of 3 VOCX tests at 200, 400 and 600 Volts
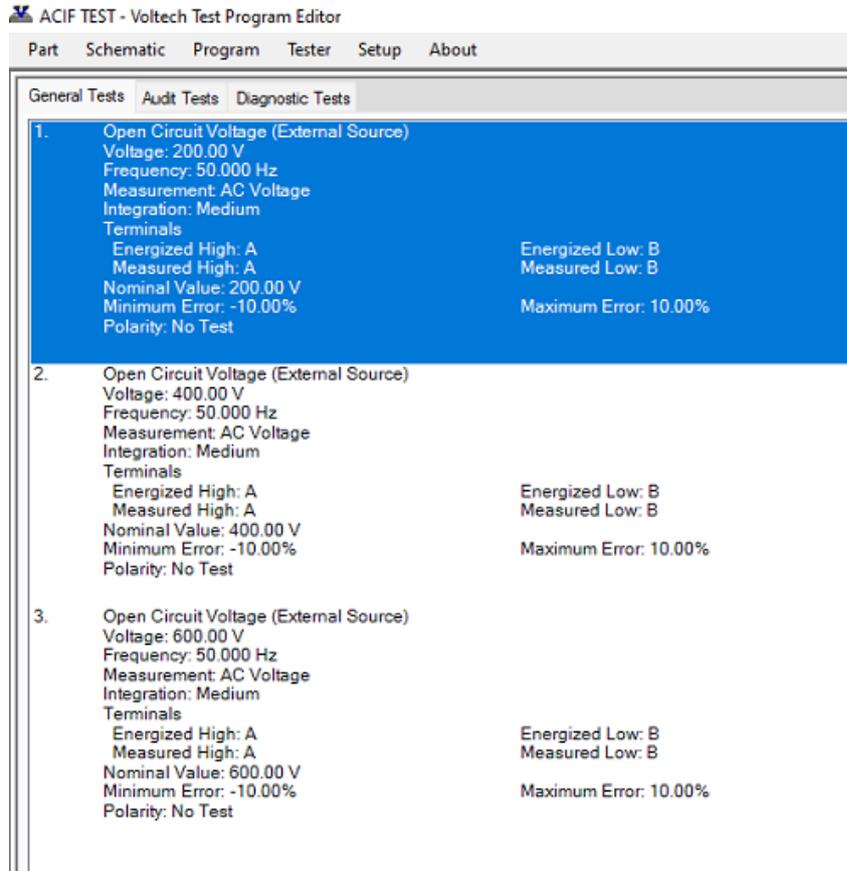
5, Check your AC SOURCE settings in SET UP are correct.

6, Run the program from the AT Editor.

The unit should apply the requested voltages to the terminals, trim to match the required voltages, and then report the measurement.

The results will be returned to the Editor , proving that the voltages were generated correctly.
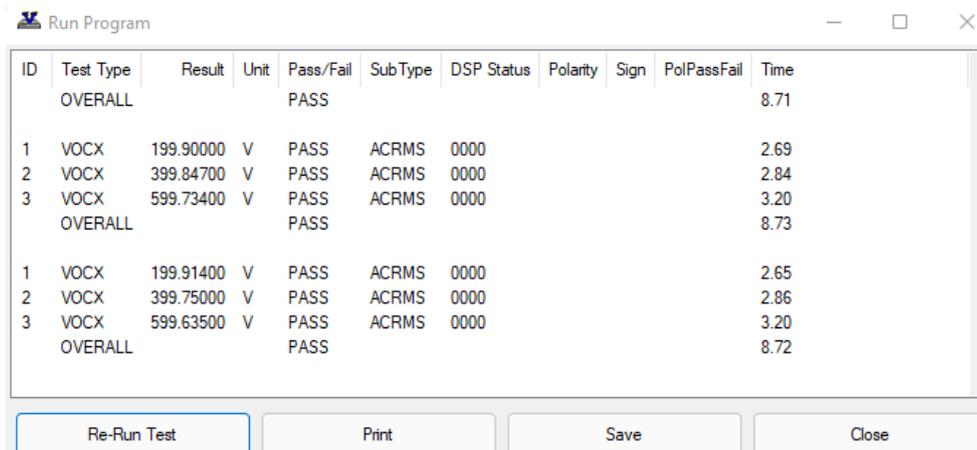
If you see warning messages on the front panel display of the AT3600/AT5600 (see the safety section of this manual), it is likely that high voltage is present. Do not touch the fixture. Follow the instructions given on the panel. The source controls are not working properly, and you should investigate.

Other errors may be reported by the Editor because the source has not switched on at all, has switched on at the wrong voltage, or the voltage sense leads are not connected.

Check all connections, the gain settings for the source configuration in the PC Editor and that the fixture wiring is the same as that described in the Editor.

Only after performing a successful 'no load' test should you attempt to test parts.

If errors occur during testing, check as above but make sure that the source (including the transformer type) can provide the voltage, current and frequency that you expect.

3.5. USE OF X TESTS IN AN AT EDITOR ATP PROGRAM.

Once the above tests have passed you can now add the "X tests" (MAGX VOCX WATX and STRX) into a test program.

These are programmed in the same way as the "on board" Class- D tests (VOC MAGI WATT STRW) but will allow you to use the higher excitation voltages.

These can be used in conjunction with the other standard AT test options, and in any order.

Points to note

1, Order of tests
For speed of execution, it is better to keep the AC INTERFACE tests together in one block where possible, especially if they all share the same V and F settings.

See AT dot net Editor user manual 98-125 Section 4 for suggestions for test ordering to optimize speed.

2, Integration with HIPOT tests
See next section 3.6+3.7 for best practice when using the AC IF with HIPOT tests.

3, Max X TEST voltage.
Please remember that the maximum allowed requested voltages are defined by the Amp or Transformer gain you have set in the external source set up.

For example
       Using a 2:1 Step up transformer
              AT output = 270 V
              Max "X test" voltage programmable is 270 * 2 = 540 V

       Using a power amp with gain of 25
              ACIF ESD drive max output = 5 V
              Max "X test" voltage programmable is 5 * 25 = 125

If you attempt to request more Volts that your configuration will allow, you will see the following prompt on save.

Editor   ✕

⚠ The program save has been aborted, because the requested voltage, in one or more
external source tests, cannot be achieved with the current source configuration.

OK
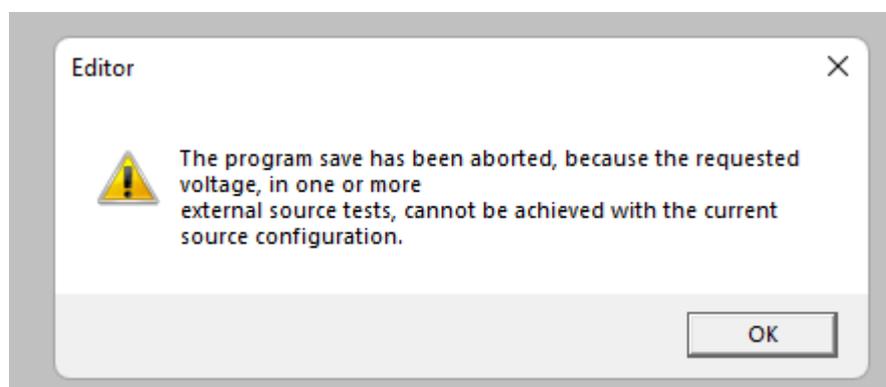
3.6. INTEGRATION OF AC INTERFACE TESTS WITH IR, HPDC, HPAC, DCRT, ACRT, DCVB, ACVB TESTS

This applies when writing test programs combining the AC Interface "X" tests with any of the following standard AT tests; IR, HPDC, HPAC, DCRT, ACRT, DCVB, ACVB Tests (High Voltage Tests)

IMPORTANT: Voltech AT5600 / AT3600 programs that include any of these tests should be written such that the AC Interface output (and connected winding) is only ever used as the LO terminal on any HI POT test,

The AC interface should <u>NEVER</u> be connected to a node that is also used by a test, in the same program, as a HI terminal for a HI POT test.

This is so that the AC Interface unit is always kept at low potential with respect to Earth.

The following illustrates this principle the fixture and wiring has been constructed so that the HI and LO connections from the AC Interface are hard wired to Nodes 3 & 4, which are then used as LO in the following HPAC test.
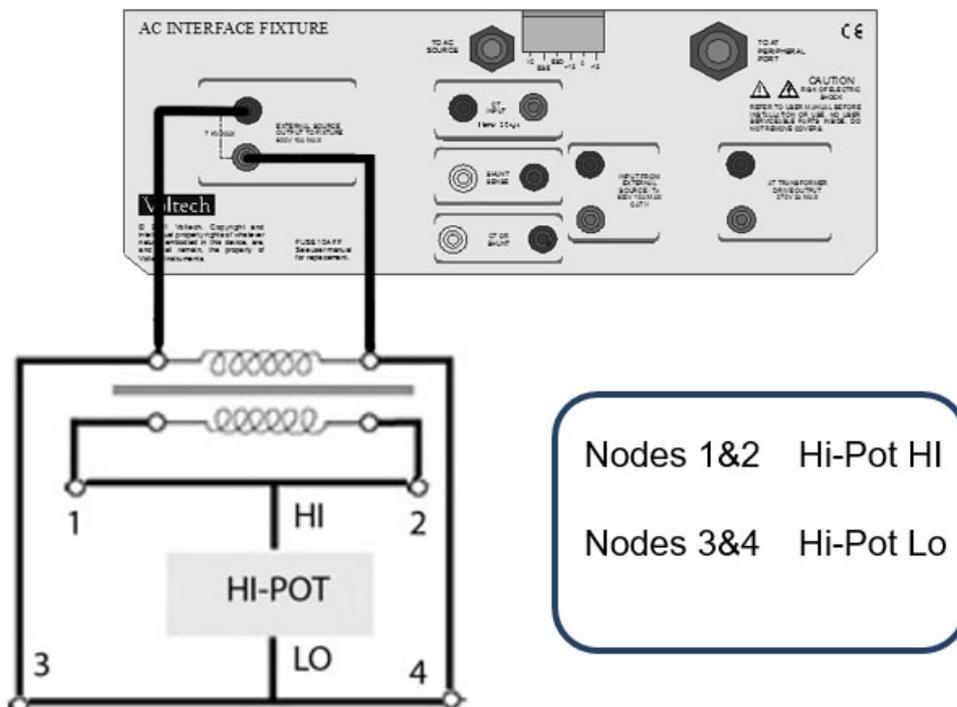
Newer versions of the AT EDITOR will detect violations to this rule and warn you. In most cases, simply reversing the HI LO nodes on the HPAC HPDC tests will resolve this conflict.
As the choice of HI / LO for HIPOT testing is largely arbitrary it will not affect the low current measurement made during a HIPOT test

3.7. INTEGRATION OF AC INTERFACE TESTS WITH ILK, SURG, MAGI, STRW, WATT, VOC TESTS

This applies when writing test programs combining the AC Interface "X" tests with any of the following standard "on board" AT3600 or AT5600 tests; ILK, SURG, MAGI, STRW, WATT, VOC Tests

These tests must not be used on any winding on a component to which the AC Interface is attached.

Before performing any SURG, MAGI, STRW, WATT, VOC tests, the AC Interface must be isolated from the windings under test with a 2-pole safety isolation relay, controlled by the User Port.
The relays should be selected with suitable isolation to safely isolate the AC INTERFACE from any voltages you wish to apply using these tests.

This is to prevent voltages induced across the winding being transferred to the AC Interface

If these tests are required, then additional relays can be added to the test fixtures that switch out the AC IF connections so that they are isolated. These can then be controlled by the User Port (and OUT test) on the AT before and after the application of the above tests

See the OUT test in the AT series user manual for details on how to control relays for mid-test switching.

The following illustrates this setup
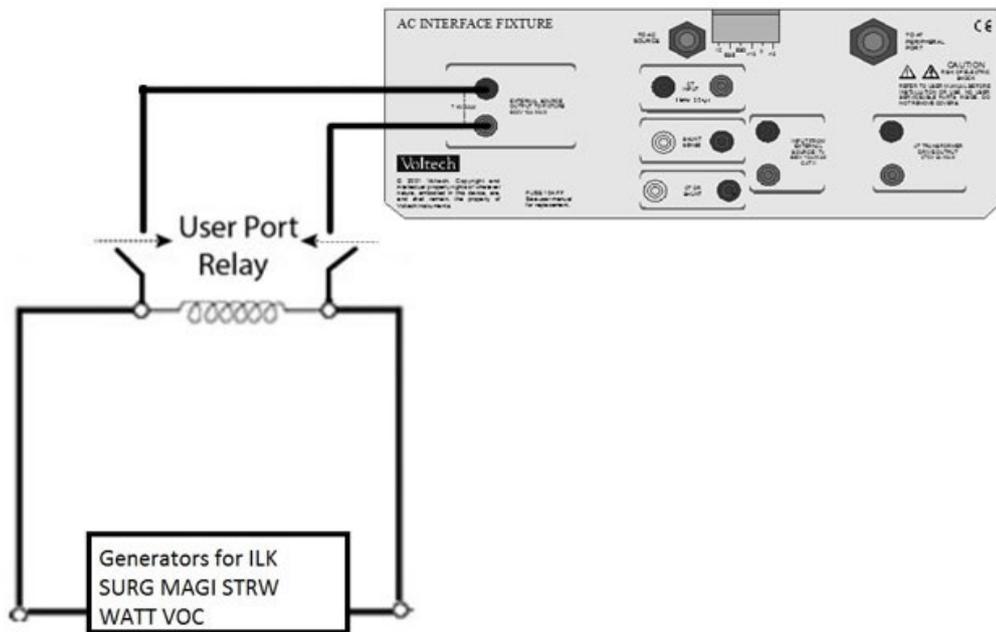
4. TECHNICAL INFORMATION

4.1. RECOMMENDED SPARES & ACCESSORIES

- Fuses:

  SIBA FF fuse no. 70 094 40

  10A RMS rated

  600V RMS rated

  Size 38.1mm long x 10.3mm wide

  RS part no. 209-9406

- True Kelvin leads, 2A rated (Voltech part no. 78-028)

- Flying lead connection post (Voltech part no. 78-026)

- Universal lead set (Voltech part no. 78-030), contains ten of each of:
     True Kelvin leads
     Flying lead connection post
     non-Kelvin croc-clip leads
     Grabber clip leads

- Universal fixture plate (20-node connection plate, Voltech part no. 91-186)

- True Kelvin leads, 10A rated (Voltech part no. 78-060)

- Sub-miniature screened 7/0.1 multi-core with minimum of seven cores for all other connections to the 6-way connection block of the AC Interface, labelled 'To AC Source' (Farnell part no. 711-380)

4.2. DETAILS OF CONNECTOR FUNCTIONS

4.2.1 'External Source Output to Fixture'

These connections are used to supply the signal from the AC Interface to the part under test.

Note that when the AT3600/AT5600 runs a hi-pot test as part of a test program, up to 7kV could be present on these connections.

It is therefore important that the leads used to make connections here are not accessible to the user without having to break the safety interlock (e.g., through a Safety light curtain), because the Voltech supplied leads, for this position are NOT SAFETY TOUCH-PROOF to 7KV.

4.2.2 'Input from External Source'

These connectors are used as the input from the external source or step-up transformer to the AC Interface.

It is a CAT-II interface, capable of carrying 600V RMS, 850Vpk and 10A RMS, 35Apk.

 It is important to observe the polarity of the signal connected here to ensure that the common-mode voltage applied to the CT primary, or shunt connections is at a minimum.

This will give maximum accuracy for current measurements.

4.2.3 'AT Transformer Drive Output'

These connections are intended to drive a user-supplied transformer for use as the external source.

They supply an output of up to 270V RMS, 2A RMS (3Apk) and a 40 W maximum, which is derived from the internal high-power amplifier of the AT3600/AT5600.

For convenience, this connection can also be made straight through the 'Input from External Source', without a transformer, to perform the same high-power tests the AT is normally capable of, or to check operation on the AC IF without the "unknown" external transformer being used, but obviously in these cases the AT editor must be set to a ratio of 1:1 and the V requested will be limited to 270V / 40 W

The maximum frequency available using this connection is 1.5kHz.

It is important to observe the polarity of the signal connected here to ensure that the common-mode voltage applied to the CT primary, or shunt connections is at a minimum.

This will give maximum accuracy for current measurements.

4.2.4 'To AC Source'

This port carries six connections that can be made by inserting wire and screwing down connections.

Terminal block:

Max. wire capability: 2.5mm^2, fine stranded

4mm^2, solid

14-12 AWG

Clamping screw torque: 0.5Nm

Cable gland:

Min. cable diameter: 4mm

Max. cable diameter: 8mm

A suitable cable to use for both connectors would be a multi-core to DEF STAN 61-12 part 5-unscreened 16/0.2 type 16-2-6A, which consists of six cores of 2.5A 440V RMS rated wire in an overall sheath of 7.3mm (EG Farnell part no. 715-608).

The following pinouts cover controlled AC source operating modes, using the 6-way output connector. This connector is comprised of six active pins:

ESE (External Source Enable Pin 2)

This optional connection is used for controlling an external source that has an enable or power-on input. It can also be used for controlling a user-supplied switch that activates power from an uncontrolled source such as the normal line supply or a variac. The output is 5V TTL compatible. It is short circuit protected. A high on this line means the power should be applied to the AC Interface Fixture.

ESD (External Source Drive Pin 3)

This connection is used to provide the analogue control signal for an analogue controlled source or amplifier. The test program that is being run in the AT controls the amplitude and frequency of this signal. When a test program is being executed, the AT will set this signal to be a sinusoid at the specified frequency between 20Hz and 5 kHz.

The signal is of 0 – 7 Vrms (+/-10Vpk). The input impedance of the amplifier should be greater than 600 Ohms.

IC (Isolator Control Pin 1)

Normally, the output voltage and current of an AC source or power amplifier are fed through the AC Interface. The Interface contains high-voltage relays that isolate the source from the AT3600/AT5600 when tests (that do not use the external source) are being performed. This allows the AT3600/AT5600 to perform small-signal tests like inductance, LS, without being loaded by the output impedance of the source, and to protect the source from damage when the AT3600/AT5600 is performing high-voltage tests like hi-pot, HPAC.

It is normally not necessary to use an external isolator, and users are strongly urged to contact Voltech before doing so. If you do wish to use an external isolating device, then this signal may be used to control that device. This output is 5V TTL compatible and short circuit protected. The external isolation switch must be closed when this line is 'high'.

Control Timing
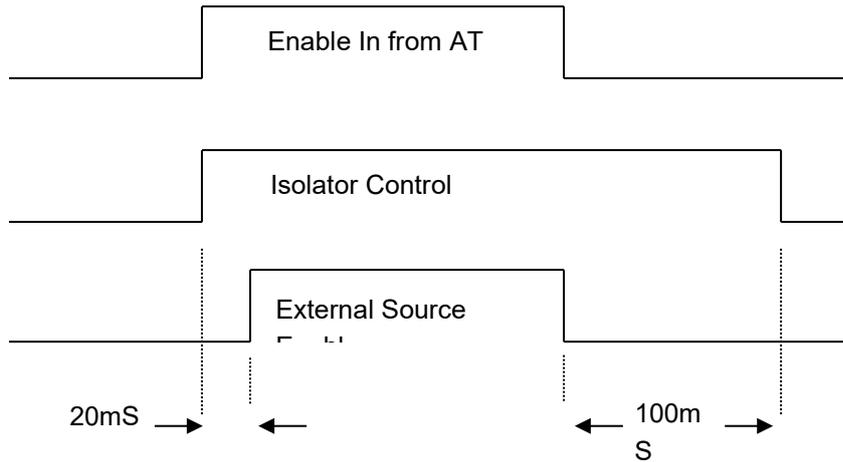
The diagram above shows the signal levels (high or low) and the times between them from when the AT3600/AT5600 asserts its enable signal. The Enable In (from AT) is not visible on any ACIF ports. It is a control line that comes in from the AT3600/AT5600 peripheral port.

When the AT initiates an external source test, it asserts Enable In and leaves this signal high until the end of the test. Within a few microseconds of 'Enable In', the Isolator Control line is also asserted. This line can therefore be used to control an external isolating switch like the relays in the AC Interface itself. In fact, this signal is used internally to switch these relays.

20mS after the 'Enable In' and 'Isolator Control' lines are activated, the 'External Source Enable' signal is activated. The ESE line must be used to go to a control port on an external source or to switch a device that applies power from an external source, where control is not possible.

The 20mS delay ensures that the AC Interface relays, or another external device connected to the Isolator Control signal have switched completely before an external source is activated, which ensures that the isolator does not switch the current on to the load.

As soon as Enable In goes low, the ESE signal is switched to low within microseconds, turning the external source off as quickly as possible. The Isolator Control line remains high for another 100mS to allow time for the source to switch off and any transients to decay.

+15V (Pin 4),

-15V (Pin 6)

This is a +15V and -15V supply. See note below for full specification.

0V (Pin 5)

This is the 0V reference for all other connections on the source control port.

Note:

> The +/-15V supply is intended for use with a current sensing module, e.g., a LEM module, which requires power to deliver current to the measurement device.

Voltage set accuracy	± 3%

Regulation   Load variation 10 - 100%

Balanced load ± 1.0% max.

Unbalanced load ± 3.0% max.

Ripple and noise   50mVpk-pk max.

Temperature coefficient   ± 0.02% / °C

Output current limitation   > 120% Iout max., constant current

Short circuit protection   indefinite

Capacitive load   470µF max.

Maximum current (Iout max)   35mA

Please note that this supply is also used internally by the AC Interface Fixture, and that the system will not function if the + or – supply is used incorrectly, although no damage will occur.

'To AT Peripheral Port' (Fixed Cable)

This part of the fixture will have a factory-fitted cable. It is not intended to be replaced by the end-user. This cable has a 15-way D connector on the end that must be plugged into the AT3600/AT5600 peripheral port. All signals to and from the AT3600/AT5600, including the power supply for the AC Interface Fixture's internal circuitry, are sent down this cable.

'CT or Shunt'

These connections are used for fitting the primary of a CT or shunt resistor in series with the power path. Without a CT or shunt fitted here, no low connection will be made to the output of the fixture. These connections will carry the same voltages and currents as the external source input.

'Shunt Sense'

These connections are wired directly in parallel with the 'CT or Shunt' connections to provide a Kelvin (or 4-wire) connection to a shunt. These connections are used to carry the sense voltage from the shunt resistor fitted to nodes 17 and 19 of the AT switching matrix.

'CT Input'

The AT3600/AT5600 can measure the current that is applied to these terminals. The secondary of any current transformer that has its primary connected to the 'CT OR SHUNT' terminal should be connected here. The maximum value is 1A RMS, 3.5Apk. The AT3600/AT5600 measures this current and multiplies the result by the CT ratio (i.e., 20 for the Voltech CT10-20) to obtain the final current value.

4.3. USING A CURRENT TRANSFORMER

The Voltech CT10-20 Current Transformer

The CT10-20 is a current transformer module that is supplied with the Voltech AC Interface Fixture to enable current measurements to be made with the AT3600/AT5600. The name is derived from its basic specification of 10Arms and a ratio of 1:20.

The CT10-20 is designed to plug directly onto the AC Interface Fixture as a module. It cannot be incorrectly fitted. Using the CT10-20 is the manufacturer's preferred method.

Specification

Turns ratio:	1:20
Frequency response:	20Hz to 20kHz
Magnitude accuracy:	Better than 2% (20Hz – 20kHz)
	Better than 1% (45Hz – 5kHz)
Phase accuracy:	Better than 3 degrees (20Hz – 20kHz)
	Better than 1 degree (45Hz – 5kHz)
Maximum current:	10Arms (15Apk)
Isolation:	4KV primary to secondary

The above specification is valid when the CT10-20 is fitted to an AC Interface Fixture that is connected to an AT3600/AT5600. The specification may vary with different burden impedances (the impedance connected across the secondary).

Selecting Other Current Transformers

A CT (current transformer) is a transformer designed not to accurately transform voltage levels between windings, as most transformers, but to transform currents.

CTs are designed to present a small series impedance on the primary winding, so the current flow in the main signal path is disturbed as little as possible.

 A CT has a proportion of the primary current flowing in the secondary that is defined by the CT turns ratio. The Voltech CT10-20 has a ratio of 1:20, so whatever current flows in the primary, 1/20 of that current must flow in the secondary.

When designing a CT, there are several important parameters that must be taken into consideration. Some of these are as follows:

1. The minimum and maximum currents to be measured.
2. The required accuracy of the measurements.
3. The burden resistance (resistance on the secondary) of the measurement device.

When choosing a CT for operation on the AC Interface Fixture, the first important parameter to make note of is the minimum current that the AT3600/AT5600 can measure accurately and the burden resistance that is presented to the system.

The AT3600/AT5600 can accurately measure about 1/20mA (to about 1%). As currents get smaller than this, noise in the system and other effects due to large currents flowing in the AC Interface start to swamp the true signal that is being measured.

The burden resistance in the AT3600/AT5600 changes depending on the level of the current being measured, because the internal shunt is changed automatically depending on the signal level.

1. Between 0 and 12mA peak, the burden is 12 Ohms.
2. Greater currents than this result in a burden of 2.5 Ohms.

This burden resistance is reflected to the primary of the CT by the square of the turn's ratio.

$$Zp = Zs \times Np^2 / Ns^2$$

Therefore, for the Voltech CT10-20, the primary impedance $Zp = 12 \times 1^2 / 20^2 = 0.03$ Ohms (for a 12 Ohm burden) and $Zp = 2.5 \times 1^2 / 20^2 = 0.00625$ Ohms for a 2.5 Ohm burden. This ensures that the effect on the main current measurement is small.

4.4. CHOOSING AN AT OUTPUT TRANSFORMER

A step-up or step-down transformer can be used as an AC source in conjunction with the AC Interface.

The transformer can be used to either increase the voltage or the current available from the AT3600/AT5600's own internal generator.

This is an extremely versatile method to use for testing transformers, providing good control and optimum test speed.

A transformer **cannot** boost the power available from the internal generator of the AT3600/AT5600, which is **40 W.**

The transformer that you choose to use should:

- Have low losses to maximise the power available.
- Have a turns ratio with sufficient margin to absorb any voltage regulation. (Remember that the AT3600/AT5600 will attempt to trim to the desired test voltage during test).
- Have sufficient VA rating to carry the current to the winding under test.
- Be designed to operate at the range of voltage and frequency conditions that you will be using it at. If, for example the AT3600/AT5600 applies 230V, 50 Hz to a winding designed to operate at only 110V, 60Hz, the transformer is likely to saturate. The test will fail with errors.
- Preferably be housed in a safety enclosure to provide the best operator safety.
- Have all interconnecting leads inside the protected zone of the AT3600/AT5600 Light Curtain Safety System Enclosure.

5. SPECIFICATION

5.1. TESTS AVAILABLE FOR USE WITH THE AC INTERFACE

The following tests are available for use with an external AC source, when a Voltech AC Interface is used in combination with an AT3600/AT5600:

Test		User Entered Test Data			A_R[3]
		Measurement Range	Test Signal	Test Frequency[1][2]	
MAGX	Magnetizing Current	50mA to 10A	5V to 600V	20Hz to 5kHz	0.1%
VOCX	Open Circuit Voltage	100μV to 650V[4]	1V to 600V	20Hz to 5kHz	0.1%
WATX	Wattage	100mW to 6kW	5V to 600V	20Hz to 5kHz	1%
STRX	Stress Wattage	100mW to 6kW	5V to 600V	20Hz to 5kHz	1%

Notes:

1) Specification using supplied CT10-20. Up to 1MHz possible with suitable current transducer.
2) 1.5kHz when using the AT3600/AT5600's internal source to power output transformer source type.
3) A_R = basic relative accuracy
4) 650Vrms for AC measurements, or 900V for DC measurements.
5) Specification valid at 23 ± 5 °C.

5.2. MAGX – MAGNETISING CURRENT

The accuracy is based on the chosen test conditions, and is given by:

$$A_T = A_R + A_C + A_I + A_{OFF} + A_{ESI} + A_{SRCE}$$

where:

A_T is the total accuracy (%)

A_R is the basic relative accuracy (%)

A_C is the calibration accuracy (%)

A_I is the correction for current level (%)

A_{OFF} is the error in the compensation measurement (%)

A_{ESI} is the error in the source interface current (%)

A_{SRCE} is the correction for external source type (%)

The value of A_R is from Section 5.1 Specification Summary. The other factors for this test are:

$$A_C = 0.08\% + (0.001\% * F_M)$$

$$A_I = 0.03\% + (\frac{0.01\%}{I_M}) + (2 * I_M)$$

$$A_{OFF} = [0.76\% + (0.001\% * F_M)] * \frac{0.3}{I_M}$$

$$A_{ESI} = 0.5\%$$

$$A_{SRCE} = 0.5\% \ (For\ manual\ or\ line\ supply)$$

$$A_{SRCE} = 0.0\% \ (For\ analog, amplifier\ or\ AT\ output\ tx)$$

where:

F_M is the test frequency (Hz)

I_M is the measured current (A)

During a MAGX test, the AT3600/AT5600 automatically applies the test voltage to the part under test and checks that the voltage has stabilized before recording measurements.

The time that the voltage takes to stabilize will vary with the source type used and the nature of the part under test. In general (and especially for source types 'Programmable' and 'AT Output Transformer'), the AT3600/AT5600 will record a measurement very quickly, (typically in less than 0.5 seconds) which is desirable in a production test environment.

If the measurement were to be recorded after a longer period under power, slightly different readings may be obtained due to self-heating effects in the part under test.

This effect may be noticed when comparing results taken using different source types or with slower measurement systems.

5.3. VOCX – OPEN CIRCUIT VOLTAGE

The accuracy is based on the chosen test conditions, and is given by:

$$A_T = A_R + A_C + A_V + A_{SRCE}$$

where:

A_T	is the total accuracy (%)
A_R	is the basic relative accuracy (%)
A_C	is the calibration accuracy (%)
A_V	is the correction for voltage level (%)
A_{SRCE}	is the correction for external source type (%)

The value of A_R is from Section 5.1 Specification Summary. The other factors for this test are:

$$A_C = 0.08\% + (0.001\% * F_M)$$

$$A_V = 0.03\% + (\frac{0.01\%}{V_M})$$

$$A_{SRCE} = 0.5\% \ (For \ manual \ or \ line \ supply)$$

$$A_{SRCE} = 0.0\% \ (For \ analog, amplifier \ or \ AT \ output \ tx)$$

where:

F_M	is the test frequency (Hz)
V_M	is the measured voltage (V)

During a VOCX test the AT3600/AT5600 automatically applies the test voltage to the part under test and checks that the voltage has stabilized before recording measurements.

The time that the voltage takes to stabilize will vary with the source type used and the nature of the part under test. In general (and especially for source types 'Programmable' and 'AT Output Transformer'), the AT3600/AT5600 will record a measurement very quickly, (typically in less than 0.5 seconds) which is desirable in a production test environment.

If the measurement were to be recorded after a longer period under power, slightly different readings may be obtained due to self-heating effects in the part under test.

This effect may be noticed when comparing results taken using different source types or with slower measurement systems.

5.4. STRX & WATX – STRESS WATTAGE & WATTAGE

The measurement accuracy is based on the chosen test conditions, and is given by:

$$A_T = A_{MAGX} + A_{VOCX} + A_{PF}$$

where:

    A_T is the total accuracy (%)

    A_{MAGX} is the accuracy of the MAGX current measurement (%)

    A_{VOCX} is the accuracy of the VOCX voltage measurement (%)

    A_{PF} is the correction for power factor (%)

The accuracies of the MAGX and VOCX measurements are computed from the formulae in 5.2 and 5.3

$$A_{PF} = [1\% + (0.001\% * F_{M)}] * \frac{\sqrt{1 - PF^2}}{PF}$$

where:

    F_M is the test frequency (Hz)

    PF is the power factor of the load

and:

$$PF = \frac{W}{VA}$$

where:

    W is the measured power (W)

    VA is the product of MAGX and VOCX results

When performing either of these tests, the AT3600/AT5600 automatically applies the test voltage to the part under test and checks that the voltage has stabilized before recording measurements.

The time that the voltage takes to stabilize will vary with the source type used and the nature of the part under test.

In general (and especially for source types 'Programmable' and 'AT Output Transformer'), the AT3600/AT5600 will record a measurement very quickly, (typically in less than 0.5 seconds) which is desirable in a production test environment.

If the measurement were to be recorded after a longer period under power, slightly different readings may be obtained due to self-heating effects in the part under test.

This effect may be noticed when comparing results taken using different source types or with slower measurement systems.

5.5. TYPICAL EXTERNAL AC SOURCE SPECIFICATION

AC power amplifier:

Voltage Input: 0-7.07 Vrms (+/-10Vpk)

Input impedance > 600Ω.

Input at rear.

Voltage gain: x 100 typically. 9programmable in AT EDITOR set up)

Current: Up to 10Arms, 30 A 'continuous' peak
 (e.g., crest factor of 3 at 10Arms).

Voltage Output: 5V minimum, 600V AC RMS maximum.

Frequency range: 20Hz to 5 kHz.

AT output transformer:

Frequency range: 20Hz to 1.5 kHz.

5.6. GENERAL

Size: 290mm x 110mm x 32mm

Weight: Approx. 750g

Power supply: Powered by the AT3600/AT5600

Operating temperature: 0 to 40°C

Storage temperature: –40 to 70°C

Humidity: 10 to 90% RH, non-condensing

5.7. EMC COMPLIANCE

DECLARATION OF CONFORMITY

Manufacturer's name: Voltech Instruments Ltd

Manufacturer's address: 66 Innovation Drive

Milton Park

Abingdon

Oxfordshire

OX14 4RQ

UK

Declares that the product:'**AC Interface**' conforms with the following product specifications, when used with a Voltech AT3600/AT5600 Transformer Tester:

Safety: IEC 61010-1:2010 (3rd Edition)

EMC: IEC 61326-1:2012, Class A, Table 1

Signed for on behalf of Voltech Instruments

Dr John Ford, Managaing Director   26 June 2018

5.8. EMC PRECAUTIONS

Conducted and Radiated Emissions

The AC Interface Fixture complies with the limits of **IEC** 61326-1:2012, Class A, Table 1, when used in conjunction with an AT3600/AT5600 transformer tester.

Immunity

The AT3600/AT5600 and AC Interface Fixture may be susceptible to fast electrical transients on the power line and electrostatic discharges, which may disrupt the operation of the unit.

In the event of such an occurrence, to return the system to normal operation:

Switch off the power to the AT3600/AT5600.

Wait 5 seconds.

Switch the tester on again.

5.9. CHANGE LOG

90-027 issue 8

Updated Watts limit when using on board class D drive with step up Transformer from 25 Watts to 40 Watts.

This is because we have been able to up-rate the AT54600 to match the AT3600 performance of 40 Watts.

This requires an AT5600 firmware upgrade only (v1.004.012 or later)

6. WARRANTY & SERVICE

6.1. WARRANTY

The Voltech AC Interface Fixture is warranted against defects in materials and workmanship for a period of twelve (12) months from the date of shipment.

In the event of failure of a customer unit during this period, Voltech will:

- At Voltech's discretion, repair or replace the faulty unit free-of-charge for a unit returned to an authorized service centre. Shipment from the customer address will be the responsibility of the customer.
  Voltech reserves the right to waive this benefit in any event where it is clear upon inspection that the cause of the failure is due to customer misuse.
  Voltech will be the sole arbiter in this circumstance.
- Pay all return shipment charges from the Voltech service centre to the customer.
- Repair/verify the customer unit before dispatch. A certificate of verification will be issued as a matter of course.

Because software is inherently complex and may not be completely free of errors, you are advised to verify your work. In no event will Voltech be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of or inability to use software or documentation, even if advised of the possibility of such damage.

Voltech is not responsible for any lost profits or revenue, loss of use of software, loss of data, cost of substitute software, claims by third parties, or for other similar costs. In no case shall Voltech's liability exceed the amount of the license fee.

6.2. SERVICE

To confirm the accuracy of your AC interface fixture, a verification check should be carried out every 12 months.

Verification is carried out using purpose-built equipment.
The verification can be performed by an authorised Voltech service centre.

For details of verification facilities and any other service requests, contact your supplier.

6.3. OBTAINING SERVICE AND APPLICATIONS SUPPORT

Voltech personnel will be happy to help you with any query that you may have. Please e-mail your local supplier or your regional Voltech service centre, as listed at the front of this manual.

To ensure we provide the fastest possible support, we may ask you for:

- The serial number of your AC Interface Fixture (found on the back of the fixture)
- The firmware revision level of the AT3600/AT5600 that you are using (shown on the AT3600/AT5600's front panel during power-on)
- The software revision levels of the PC Editor and Server software that you are using.

7. SAFETY INFORMATION

7.1. SAFETY FEATURES

The AC Interface has been designed with several fault-tolerant safety features that provide the operator with a high level of protection against the risk of electric shock. As with any dangerous equipment, however, it is important that an assessment of the overall risk to safety is made during installation. It is the user's responsibility to ensure compliance with any regulations that may be applicable to the health and safety of operators.

7.2. SAFETY INSTRUCTIONS

WARNING:

Voltech's AC Interface Fixture can pass voltages of up to 600VRMS and 10ARMS during testing.

It is essential that an approved safety interlock system, such as the Voltech light curtain, is installed and maintained in accordance with the guidelines given in the AT3600/AT5600 user manual.

- Do not coil any of the high-voltage connection leads.
- Replace the fuse only with the same type and rating as specified in this manual.
- Refer servicing only to qualified personnel who understand the danger of shock hazards.
- Ensure operators are aware of the potential shock hazard.
- Ensure operators are trained to avoid contacting the part being tested or any exposed parts of the fixture during testing.
- Beware of energy stored with the capacitance or inductance of the part being tested when handling the part after test.
- Whenever possible use the external source enable line to switch off the external source when not in use.
- Ensure that all equipment used is earthed.
- Ensure that cables are secure.

Maintenance

- Test the safety interlock system weekly.

- Examine all test leads for damage to insulation by overheating weekly and replace if required.

- Return the AC Interface and all leads to Voltech annually for a safety and performance verification.

7.3. ERROR MESSAGES

There are three error messages relating to faults within the AC Interface Fixture:

For AT3600 only

1. Open Circuit Compensation Error:

The external source is not connected to the Open Circuit Fixture.

2. Internal fault condition:
   Safety interlock open (also shows "Safety Interlock Open" message on the AT3600 display). The error message displayed in the PC Editor is shown below.

A fault has occurred with the external source.

Please check the status of the external source interface and refer to user manual.

Should this error occur, check the operation and installation of the safety light curtain (see AT3600 user manual).

3. When the AT detects a residual voltage level >40V preceding a test, the error message shown below is displayed on the AT3600's front panel.
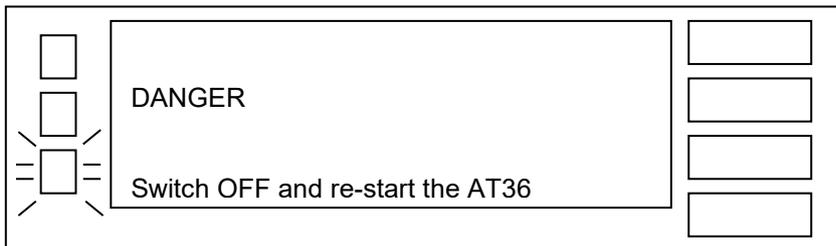
Should this occur.

    a.   DO NOT TOUCH THE PART UNDER TEST OR THE FIXTURE.

    b.   Switch off the AC source.

    c.   Switch off the AT3600.

    d.   Check to make sure the part under test is safe to touch before removing it and powering on the AT3600 and AC source.

For AT5600 only

Open Circuit Compensation Error:

The external source is not connected to the Open Circuit Fixture.

Internal fault condition: Safety interlock open:

"Safety Interlock Open" message on the AT5600 display as shown below.

Should this error occur; check the operation and installation of the safety light curtain (see AT5600 user manual).

Voltage Present Condition:

When the AT5600 detects a voltage level >40V preceding a test, the error message shown below is displayed on the AT5600's front panel.
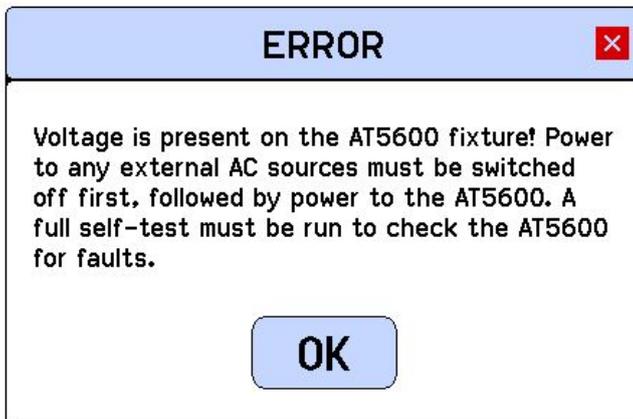
Should this error occur,

     a.   DO NOT TOUCH THE PART UNDER TEST OR THE FIXTURE.
     b.   Switch off the AC source.
     c.   Switch off the AT3600.
     d.   Check to make sure the part under test is safe to touch before removing it and powering on the AT3600 and AC source.

7.4. COMPLIANCE WITH EN954

The AC Interface meets the requirements of category 3 of EN954 (safety-related parts for control systems), and as such will protect against most faults associated with high-voltage AC sources.

Should any single part fail in the AC Interface Fixture, there will be no loss of the safety system function.

Of the three test modes, maximum protection is afforded to the high-power generator (used for the step-up or step-down transformer test mode), where the system will meet category 4 of EN954.

EN954 Category 4

This category defines that any single fault occurring within the safety system will not cause loss of the safety function, and any single fault will be detected before a second fault could occur creating a loss in the safety function.

The AC Interface Fixture will comply with a category 4 system when using an output transformer that is energised by a source within the AT3600/AT5600 along with a Voltech approved safety system, because the Voltech safety system guarantees that the connection to the output transformer is disconnected, when the interlock is broken.

EN954 Category 3

This category defines that any single fault occurring within the safety system will not cause loss of the safety function and recommends that, when possible, any single fault will be detected before a second fault could occur creating a loss in the safety function, although this is not mandatory.

As an extra precaution in this case, if the system is rendered unsafe, there must be a high probability that the user can avoid the hazard.

The Voltech AC Interface will always meet category 3, if connected correctly to an external AC source, as described in this manual.

The AC Interface Fixture has been designed so that any single fault will not render the system unsafe and, if multiple faults occur, a clear indication will be given to the user if dangerous voltages are present after testing a wound component