FINERO *The Quality Control Company*

Quanti™

USER MANUAL

FOREWORD

Dear Customer,

Thank you for purchasing Finero's test and measurement equipment. Finero is obliged to provide you with the best on the market available test and measurement equipment. Over 30 years of Finero experience in most demanding production applications is made available to you in this piece of equipment.

We are confident that this equipment will support your endeavors to keep up the good quality of your production.

If you have any comments about Finero products, software or services I would like to hear of them.

Yours truly,

Risto Vuolle
Chief Executive Officer

Finero Inc.
Kausala, Finland

DECLARATION OF CONFORMITY

CE

MANUFACTURER: **FINERO OY**

ADDRESS: **HALTONINTIE 5, 47400 KAUSALA, FINLAND**

PRODUCT NAME: **QUANTI**

CONFORMS TO THE FOLLOWING STANDARDS:

SAFETY: **61010-1: 2002**

EMC: **EN 61326**
EN 61000-3-2: 2006/ A2: 2009
EN 55022: 2006
EN 61000-4-2: 1995/ A2: 2000
EN 61000-4-3: 2006/ A1: 2008
EN 61000-4-4: 2004
EN 61000-4-5: 2006
EN 61000-4-6: 2007
EN 61000-4-11

The product herewith complies with the requirements of the Low Voltage Directive 2006/95/EY and the EMC Directive 2004/108/EY.

The CE marking has been affixed on the device according to article 10 of the EMC Directive 2004/108/EY.

The technical file and other documentation are on file with Finero Oy.

Risto Vuolle, CEO

Finero Oy

Kausala, Finland

October 28, 2010

GLOSSARY OF TERMS

AS USED IN THIS MANUAL

HIGH VOLTAGE CHAPTER

AC

Alternating current, AC: Current which reverses direction on a regular basis, commonly in the U.S.A 60 times per second, in other countries 50 times per second.

CLASS I EQUIPMENT

Product that use basic insulation in combination with an additional safety level of using protective earth. Class I products have a three-prong power cord.

CLASS II EQUIPMENT

Product that relies not only on basic insulation but an additional safety level of supplemental insulation or reinforced insulation. Class II products typically have a two-prong power cord.

CURRENT

The movement of electronics through a conductor. Current is measured in amperes, milliamperes, microamperes, nanoamperes or picoamperes. Symbol = I.

DC

Direct Current, DC: Current which flows in one direction only. The source of direct current is said to be polarized and has one terminal which is always at a higher potential than the other.

DEVICE UNDER TEST (DUT)

The product being tested.

DIELECTRIC

An insulating material which is positioned between two conductive materials in such a way that a charge or voltage may appear across the two conductive materials.

ELECTRICAL SHOCK

An electric shock occurs when a person comes into contact with an electrical energy source. Electrical energy flows through a portion of the body causing a shock. Exposure to electrical energy may result in no injury at all or may result in devastating damage or death. Burns are the most common injury from electric shock.

GROUND

The base reference from which voltages are measured, nominally the same potential as the earth. Ground is also the side of a circuit that is at the same potential as the base reference.

HIGH LIMIT

The high limit is the upper value for a test to be considered a pass. If the measured value is higher than the high limit the test is considered a fail. In dielectric withstand (hipot), leakage current and ground bond test modes a high limit is required.

HIGH VOLTAGE CHAPTER

INSULATION

The protection against unwanted flow of current through a path, as between a circuit of a product and the ground reference. Materials that prevent current flow are referred to as insulators or dielectrics.

LOW LIMIT

The lower value for a test to be considered a pass. If the measured value is lower than the low limit the test is considered a fail. In insulation resistance mode a low limit is required.

RAMP

The gradual increase or decrease of voltage or current over a period of time (step).

VOLTAGE

Electrical pressure, the force which causes current through an electrical conductor. Symbol = V.

GROUND BOND CHAPTER

AC

Alternating current, AC: Current which reverses direction on a regular basis, commonly in the U.S.A 60 times per second, in other countries 50 times per second.

CE MARK

CE marki is a mandatory conformance mark on many products placed on the single market in the European Economic Area (EEA). The CE marking certifies that a product has met EU consumer safety, health or environmental requirements. CE stands for conformité européenne, French for "European conformity". By affixing the CE marking to a product, the manufacturer – on his sole responsibility – declares that it meets EU safety, health and environmental requirements.

CLASS I EQUIPMENT

Product that use basic insulation in combination with an additional safety level of using protective earth. Class I products have a three-prong power cord.

CURRENT

The movement of electronics through a conductor. Current is measured in amperes, milliamperes, microamperes, nanoamperes or picoamperes. Symbol = I.

CONDUCTOR

A solid or liquid material which has the ability to let current pass through it, and which has a volume resistivity of no more than 10^3 ohm-cm.

DC

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GROUND BOND CHAPTER

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OHM'S LAW

The fundamental law of electrical circuits that describes the relationship between voltage, current and impedance (or resistance). For DC circuits, Ohm's law states that Current = Voltage / Resistance. For AC circuits, Current = Voltage / Impedance. Stated conversely, Voltage = Current x Resistance (DC) or Current x Impedance (AC). The difference between the DC resistance and AC impedance is that AC circuits must deal with phase and time relationships and DC circuits do not.

RESISTANCE

That property of a substance which impedes current and results in the dissipation of power in the form of heat. The practical unit is the ohm. Symbol = R.

VOLTAGE

Electrical pressure, the force which causes current through an electrical conductor. Symbol = V.

INSULATION RESISTANCE CHAPTER

CLASS I EQUIPMENT

Product that use basic insulation in combination with an additional safety level of using protective earth. Class I products have a three-prong power cord.

CLASS II EQUIPMENT

Product that relies not only on basic insulation but an additional safety level of supplemental insulation or reinforced insulation. Class II products typically have a two-prong power cord.

CURRENT

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PHASE

The time relationships between alternating voltages, currents, and impedances. Usually expressed as complex vectors with "real" (in-phase) and "reactive" (out of phase) components.

RAMP

The gradual increase or decrease of voltage or current over a period of time (step).

VOLTAGE

Electrical pressure, the force which causes current through an electrical conductor. Symbol = V.

DMM CHAPTER

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TABLE OF CONTENTS

CHAPTER I - INTRODUCTION

1. DELIVERY SCOPE LIST

Although Finero packages the equipment with utmost care you should check the package regarding any delivery damages. If the equipment is damaged you should contact your insurance company directly and inform Finero as well about the matter. Please include photos if possible.

The package should include in minimum following documents and materials:

- **QUANTI DEVICE**

- **CALIBRATION CERTIFICATE**

- **POWER CORD**

- **TEST LEADS (please see the Test leads.pdf, can be found from the CD)**

- **CD WITH THIS USER MANUAL**

2. LIMITED WARRANTY

All of our products and test systems are covered by a standard 12-month limited warranty period. The warranty period starts on the original shipment date of the product or test system. Our product and test system warranties guarantee that our products will be free from defects in material and workmanship and we will repair or replace any such Finero product or test system we find to be defective.

All new Finero products and test systems are calibrated prior to shipment. Finero products and test systems require annual calibration, if Finero has not given any other written instruction, and Finero accepts only calibrations made by an approved Finero partner or by Finero factory. If your product during the 12-month warranty period fails to perform as Finero has specified please return the product to the below address or to one of our approved partners. Warranty work includes parts and labor at Finero's cost, but excludes shipping costs. Labor outside Finero facilities is charged extra.

Finero products returned for warranty repair and found to be in proper working order may be subject to a shipping and handling fee.

Any non-authorized modification, repair, tampering or physical damage or if the product has been subject to gross misuse will void this warranty. Elimination of any connections in the earth groun-ding system or bypassing any safety systems will void this warranty. Parts subject to wear, such as test probes and leads, are not covered by this product warranty, except where they are deemed to have a manufacturing defect within 60 days of the original shipment of the Finero product. Except as provided herein, Finero makes no warranties to the purchaser of Finero products and test systems and all other warranties, expressed or implied (including, without limitation, merchantability or fitness for a particular purpose) are hereby excluded, disclaimed and waived.

FINERO SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT CONSEQUENTIAL, INCIDENTAL OR OTHER SIMILAR DAMAGES SUFFERED BY THE PURCHASER OR ANY THIRD PARTY, INCLUDING WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS OR BUSINESS OR DAMAGES RESULTING FROM USE OR PERFORMANCE OF THE PRODUCT OR TEST SYSTEM, WHETHER IN CONTRACT OR IN TORT, EVEN IF FINERO OR ITS AUTHORIZED REPRESENTATIVE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, AND FINERO SHALL NOT BE LIABLE FOR ANY EX-PENSES, CLAIMS, OR SUITS ARISING OUT OF OR RELATING TO ANY OF THE FOREGOING.

Return address: Finero Oy, Service and Calibration, Haltonintie 5, 47400 Kausala, FINLAND

E-mail: fineroservice @ qacontrol.com

3. GENERAL SAFETY

Before testing can be started, the user should become familiar with this user manual and the operation of the device.

In order to prevent electric shock do not remove the instrument cover. There are no user serviceable parts inside. Routine maintenance or cleaning of internal parts is not allowed and neither necessary. **If equipment is opened warranty is void**.

Any external cleaning should be done with a clean dry or slightly damp cloth. Avoid the use of cleaning agents or chemicals to prevent any foreign liquid from entering the cabinet through ventilation holes or damaging controls and switches, also some chemicals may damage plastic parts or lettering.

Schematics, when provided, are for reference only. Any replacement cables and high voltage components should be acquired directly from Finero. Refer servicing to an authorized Finero service center.

Because any electrical safety test involves some risk of electrical shock, it is crucial that certain precautions are taken into consideration to avoid shock and injury to operators. Listed below are some precautions that can minimize the danger of electrical shocks and ensure all-around safety:

- Train operators in the basic theory of electrical circuits and explain the object of each test.
- Review and update all safety test procedures regularly.
- Locate the testing area away from walkways and crowded areas on the shop floor.
- Guard the testing area with nonconductive barrier.
- Mark the testing area with a clear and visible sign such as "Danger" or "High Voltage Present."
- Mark the testing area with a clear sign indicating "Qualified Personnel Access Only."
- Ensure that all test equipment is properly connected to a reliable earth.
- Connect the complete test setup to a palm-type switch that can shut off the power to the test bench in case of an emergency
- Reconfigure all testers (where possible) with push-button switches so that operators must use both hands to activate the test equipment or, alternatively, provide the equipment with a safety interlock that automatically shuts down the high voltage when a safety switch on the EUT is opened
- If unsure please consult authorized personnel

3.1 Test station

Perform the tests on a non-conducting table or workbench, if possible. If you cannot avoid using a conductive surface, be certain that it is connected to a good earth ground and the high voltage connection is insulated from the grounded surface.

There should not be any metal in the work area between the operator and the location where products being tested will be positioned. Any other metal in the work area should be connected to a good ground, never left "floating".

Position the tester so that the operator does not have to reach over the Device Under Test (DUT) to activate or adjust the tester. If the product or component being tested is small, it may be possible to construct guards or an enclosure around the device to be tested. Construct the guards of a nonconducting material such as clear acrylic, so that the item being tested is within the guards or enclosure during the test. If possible, the guards or enclosure should also contain safety switches that will not allow the tester to operate unless the guards are in place or the enclosure closed.

Keep the area clean and uncluttered. All test equipment and test leads that are not necessary for the test should be removed from the test bench and put away. It should be apparent to both the operator and to any observers, which product is being tested, which product is waiting to be tested, and which has already been tested.

3.2 Operator

This instrument may generate voltages and currents that can cause **harmful or fatal electric shock** and must only be operated by a skilled worker trained in its use.

The operator should understand the electrical fundamentals of voltage, current, and resistance. They should recognize that the test instrument is a variable high-voltage power supply with the return circuit directly connected to earth ground, therefore, current from the high voltage output will flow through any available ground path.

Rules

Operators should be thoroughly trained to follow all of the aforementioned rules, in addition to any other applicable safety rules and procedures. Defeating any safety system should be considered a serious offense with severe penalties such as removal from the high voltage testing job.Allowing unauthorized personnel in the area during a test should also be dealt with as a serious offense.

Dress

Operators should not wear jewelry that could accidentally complete an elector circuit.

Medical Restrictions

Personnel with heart ailments or devices such as pacemakers should be informed that the voltages and currents generated by the instrument are very dangerous. If contacted it may cause heart-related problems that a person of good health may not experience. Please have the test operator consult their physician for recommendations

3.3 Instrument connections

Instrument connections for each test vary, depending on Quanti model that has been ordered. The instrument connections for each function can be seen on their own chapters.

3.4 Device under test

When testing with DC, always discharge the capacitance of the Device Under Test (DUT) and anything the high voltage may have contacted, such as test fixtures, before handling it or disconnecting the test leads.

Never touch the Device Under Test (DUT) or anything connected to it if high voltage is applied.

3.5 Inverter shutdown

In case of inverter shutdown, turn off the power and unplug the power cord.

3.6 External safety circuit

Quanti provides an external safety circuit; which prevents connection of the test voltage, when external safety circuits are open. The safety circuit connector is a part of the external D25 connector. When the safety circuit is open and user tries to start test, test won't start and Quanti will give an indication on the screen.

Quanti's internal safety circuit is not an approved safety relay system!

The safety circuit of Quanti is designed for indication that for instance doors and test covers are closed or respectively open. The safety device shall have potential free contact "open" when activated. The safety circuit can be wired by signal cable; the voltage is about 25 V. Before taking the safety circuit into use a jumper J1 (Safety) has to be removed. Location of the jumper J1 is in the connection board inside Quanti, near the back edge. The jumper is removed by lifting it and can be stored by pressing it to one of the pins. Cables to external control lines are recommend to be kept short or use relays near Quanti.

Time diagram   **D25 Connector**
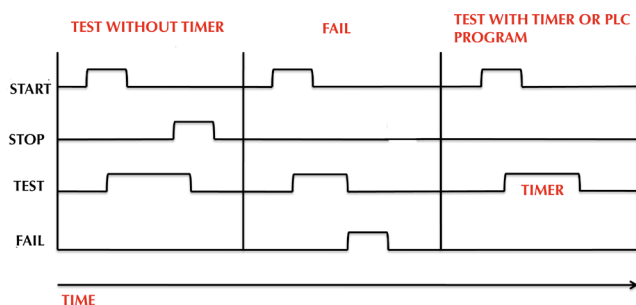
X2-5 – X2-9	+ 25V
X2-22	INPUT 1
X2-10	START
X2-23	INPUT2
X2-11	STOP
X2-1	SAFETY CIRCUIT
X2-3	DISCHARGE
X2-2	TEST ON
X2-4	FAULT
X2-24	OUTPUT1
X2-25	OUTPUT2
X2-17 – X2-27	0V

4. SERVICE AND MAINTENANCE

The instrument, its power cord, test leads, and accessories must be returned at least once a year to an authorized Finero service center for calibration and inspection of safety related components. Finero will not be held liable for injuries suffered if the instrument is not properly maintained and safety checked annually.

Service and maintenance address:

Finero Oy
Service and Calibration
Haltonintie 5
47400 Kausala
FINLAND

Tel. +358 (0) 5 752 2200
fineroservice@qacontrol.com

RETURNING THE INSTRUMENT

When it is necessary to return the instrument for servicing or calibration, repackage the instrument in its original container, please include all accessories and test leads. Indicate the nature of the problem or type of service needed. Also, please mark the container "FRAGILE" to insure proper handling. **Finero will not pay for the delivery costs**.

CHAPTER II - PRODUCT OVERVIEW

1. PANEL INTRODUCTION

1.1 Front panel connections

Example picture, varies by ordered model
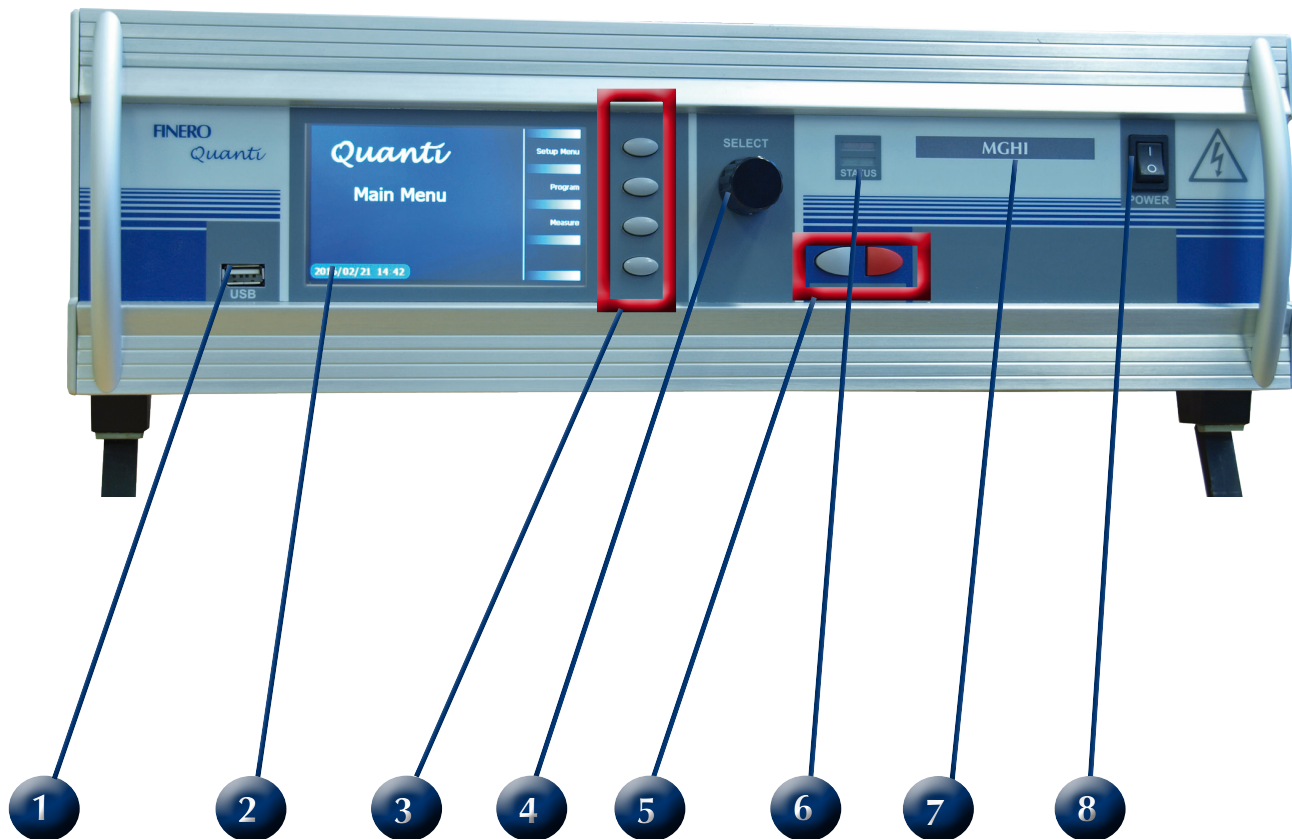
1. = USB SLOT - USB slot available in the front panel for storing and transferring test results without a connection to a PC

2. = DISPLAY - 4.3" Graphical display with 16 million colors

3. = SOFT BUTTONS - For easy navigation through different display menus.

4. = FLY WHEEL KNOB - For choosing different tests, measurement ranges and setting up parameters.

5. = START / STOP BUTTONS

6. = TEST STATUS LIGHTS

7. = QUANTI MODEL - Indicates the type of your Quanti device.

8. = POWER SWITCH

1.2 Back panel connections

Example picture, varies by ordered model
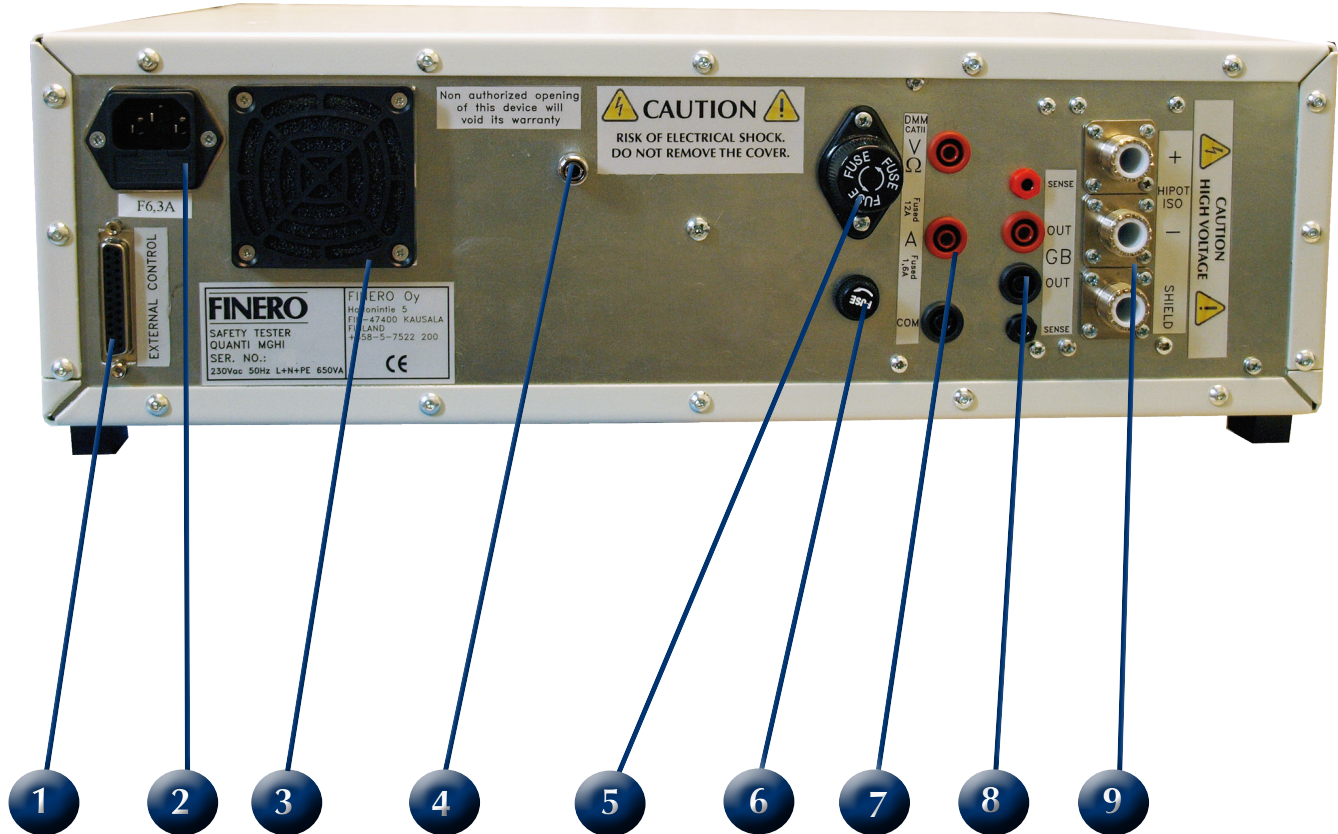
1. = PLC REMOTE CONNECTOR - Limited external control of Quanti device with PLC

2. = POWER CORD RECEPTACLE

3. = COOLING FAN

4. = CHASSIS GROUND TERMINAL

5. = FUSE FOR DMM

6. = FUSE FOR DMM

7. = DMM OUTPUT CONNECTORS

8. = GROUND BOND OUTPUT CONNECTORS

9. = HIGH VOLTAGE AND INSULATION RESISTANCE OUTPUT CONNECTORS

2. GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS	
POWER REQUIREMENTS	Rated input voltage: 110 - 240 VAC, 50 / 60 Hz Input voltage range: 100 - 250 VAC, 45 - 65 Hz
MECHANICAL	Table with tilt up feet (optional 19" rack)
WEIGHT	Depending on the model, approximately 15 - 25kg
CERTIFICATION	EN61010, EN60950 and EN61558 Safety, EN55024 and EN61000 EMC, CE, ETL (coming)
WARRANTY	12 months limited, extended warranty available on request
USB SLOT	1 USB, Type A connection in the front panel for the memory stick

PROTECTION FUNCTIONS
Fast output cut-off after fail Panel operation lock, present password (four digits) Arc detection (please see the details on page 19)

PASS / FAIL JUDGEMENT FUNCTION
Visual and audible indication

MEMORY
25 steps per sequence Test database: 20 Test sequences, single step possibility Data hold: Last 100 test results saved

DISPLAY
TFT-LCD 4.3" (480 x 272) with back light, 16 million colours

OTHER FEATURES
Calibration notification: The device notifies when the next calibration has to be done Simple to download test data to USB stick

ENVIRONMENTAL SPECIFICATIONS
Indoor use Altitude: Up to 2000m Operating temperature: +5°C to +50°C Storage temperature: -40°C to +60°C Maximum relative humidity: 80% for temperature up to 31°C, decreasing linearly to 50% relative humidity at +40°C; no condensation allowed Pollution degree is 1

DIMENSIONS

Quanti equipment is supplied in a bench configuration and there are tilt up feet under the device. The feet can be tilted up for convenient operator viewing.
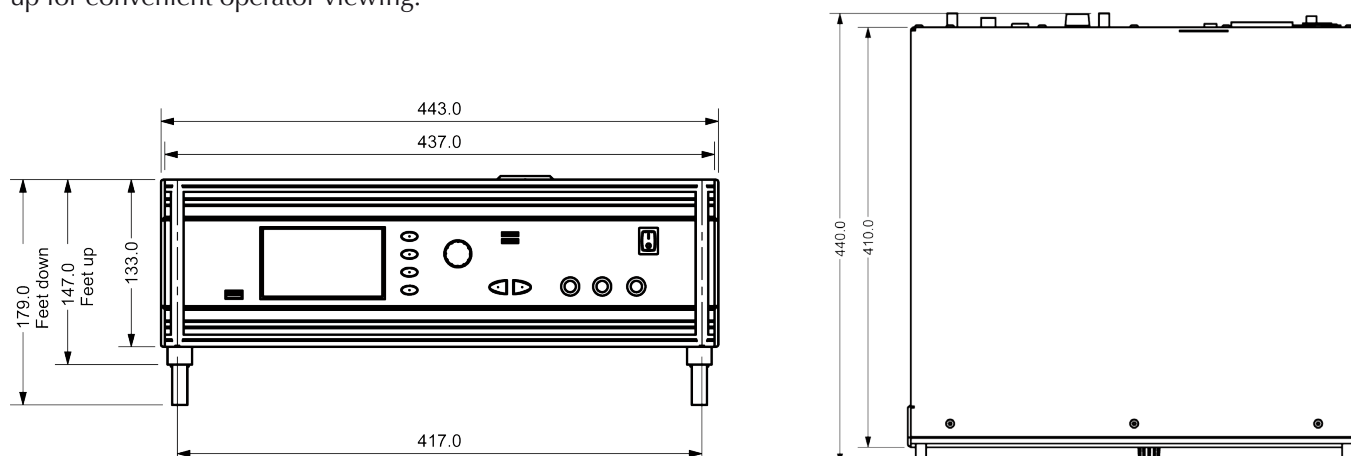
CHAPTER III - INSTALLATION

1. INSTALLATION

The optimum angle for viewieng the display is slightly down and about 10 degrees either side of the center. For bench operation the tilt up feet should always be used to angle the instrument up.

Quanti can be installed on a standard 19″ wide rack or housing. Installation height is 3U (133mm). Depth is approx. 410mm; furthermore, approximately 150mm will be needed depending on the connectors. The handles on the housing come approximately 30mm out of the front panel. On dry and dust-free premises the device can be used in its own housing, but care must be taken to ensure that nothing can enter into the device through the ventilation openings, which must not be covered. Rack option is ordered optionally.

1.1 Work area

Locate a suitable testing area and be sure you have read all safety instructions for the operation of the instrument and suggestions on the test area set-up in the Safety section ().

1.2 Power

This instrument requires a power source of 110 to 240 VAC, 50 / 60Hz.

1.3 Mounting into 19″ module - Rack or case

As the unit is heavy, when installing in an instrument cabinet or similar, rack installation set (can be ordered separately, ordering code is 6183) must be used.

Rack installation set, code 6183

Mounting holes in the front panel are for mounting only; they are not designed to carry the whole weight of the apparatus. Before installing in a cabinet, remove the footpads that are installed underneath. The footpads are removed by turning the unit carefully on either side. The relevant screws are under the skid-stop rubber pads. Ensure that the instrument cabinet is well ventilated so that the internal temperature will not rise above +35°C.

Below are some example pictures of how to build the support for rack installation (not supplied by Finero).
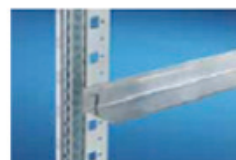
CHAPTER IV - HIGH VOLTAGE

1. GENERAL INFORMATION

High Voltage test (HV), (or also called a **Dielectric** Withstand test or Hipot test) verifies that the **insulation** of a product or component is sufficient to protect the operator from **electrical shock**. High Voltage test is done to make sure that **current** will flow from one point to another point. In a typical High Voltage test high **voltage** is applied between a product's current carrying conductors and its metallic chassis.

High Voltage test is used to make sure that a device has good **isolation** between the parts of a circuit. Having good isolation helps to guarantee the safety and quality of electrical circuits.

There are three common high voltage tests:

- Dielectric breakdown test
- Dielectric withstand test
- Insulation **resistance** test

Dielectric breakdown test informs how much voltage can be applied between the wires before the insulation fails. Voltage is being increased until the current increases. As a result the highest voltage the **Device Under Test (DUT)** can stand is found before the device fails.

Dielectric withstand test makes sure that the device tested withstands a required voltage for a required time. Voltage is applied for the amount of time to make sure that no current flows.

Insulation resistance testing tells whether the resistance of the insulation is high enough. For more information about the insulation resistance test**, please see the page 18.**

During a High Voltage test the operator may be at some risk.

When performing a High Voltage test, High Voltage testers usually connect one side of the supply to safety **ground** (Earth ground). The other side of the supply is connected to the conductor being high voltaged. With the supply connected like this there are two places a given conductor can be connected: high voltage or ground.

For **Class I** equipment, the high voltage is applied between the conductors and a ground. For **Class II** equipment, the application point is between the conductors and the outer surface of the product.

If there are more than two contact to be high voltage tested one contact is connected to high voltage and all others to ground. Testing a contact in this way makes sure that it is isolated from other contacts.

High Voltage test is ideal for detecting workmanship errors, design problems as well as component spacing problems. The area High Voltage tests are typically used include:

- Production line
- Research and Development Labs
- Incoming Inspection Areas
- Repair Areas

2. HIGH VOLTAGE SPECIFICATIONS

HIGH VOLTAGE FUNCTION SPECIFICATIONS			
OUTPUT VOLTAGE	0.05V - 6kV AC/DC, Fully floating		
OUTPUT REGULATION	Max ± (2% of output + 5V) from no load to full load over input voltage range		
VOLTAGE SETTING	Range: AC: 0.05 - 6000V, DC: 0.05 - 6000V Resolution: 5V Accuracy: ± (1% of reading + 5V)		
VOLTAGE MEASUREMENT	Range: 0.05 - 6000V Resolution: 1V Accuracy: ± (1% of reading + 5V)		
MAXIMUM OUTPUT CURRENT	100mA AC/DC		
MAX TEST APPARENT POWER	600VA		
MEASUREMENTS	AC Total, AC Real, DC		
CURRENT MEASUREMENT RESOLUTION	1mA : 0.1µA AC/DC 10mA: 1µA AC/DC 40mA / 100mA: 10µA AC/DC		
CURRENT ACCURACY	AC Total: ± (0.5% of range + 5 counts) AC Real: ± (1% of range + 5 counts) DC: ± (0.5% of range, + 5 counts)		
OUTPUT FREQUENCY	50 or 60 Hz, User selectable		
TEST TIME	AC: 0; 0.3 - 999.9sec (0 = continuous) DC: 0; 0.3 - 999.9sec (0 = continuous)		
RAMP TIME	AC: 0.1 - 99.9sec; No Ramp DC: 0.1 - 99.9sec; No Ramp, τ << Ramp time		
OUTPUT WAVEFORM	True Sine wave, THD < 1 %		
HI AND LO LIMIT	AC TOTAL Range: 100mA Resolution: 10µA Range: 10mA Resolution: 1µA	AC REAL Range:100mA Resolution: 10µA Range: 10ma Resolution: 1µA	DC Range: 10mA Resolution: 1µA Range: 1mA Resolution: 0.1µA
	Lo Limit: 0 = OFF		
MEASUREMENT CIRCUIT DISCHARGE TIME	< 0.2sec, see max. capacitive loads		
MAXIMUM CAPACITIVE LOAD IN DC MODE	0.03µF ≤ 6kV 0.5µF ≤ 3kV 1µF ≤ 1kV		
MEASUREMENT SAFETY	Fully floating output[1]		
ARC DETECTION	Setting mode: Programmable setting Minimum pulse width: < 5µ sec or > 5 - 100µ sec Detection current: Programmable 1 - 20mA		

1) **Except with some combination with other functions**

3. SAFETY

Before testing can be started, the user should become sufficiently familiar with the instructions of use and the operation of the tester. In addition, read carefully the emergency first aid instructions and the testing procedure. Only a qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury are intended to use Quanti.

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the manual.

The high voltage connectors in the rear panel have a dangerous high voltage during the test.

The current supplied by Quanti is high enough to cause convulsion and potentially to get trapped to the parts under High Voltage. Quanti measures the current in the circuit and shall switch the voltage off if the current exceeds the set current limit, **THIS FEATURE CANNOT BE USED AS A SAFETY MEASURE!**

NEVER TOUCH THE HIGH VOLTAGE CONNECTORS OR THE TEST LEADS IF QUANTI IS SWITCHED ON!

3.1 Floating output

A floating electrical circuit is created by separating grounds; one for the operator, one for the equipment. This method creates and intrinsically safe operator environment.

Quanti HV-output
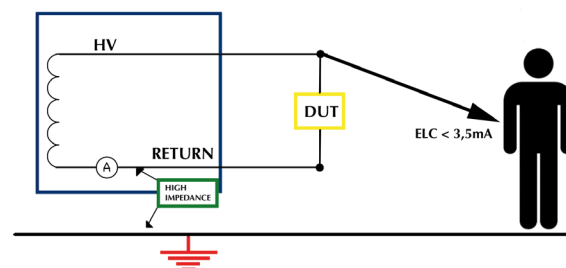
4. PERFORMING HIGH VOLTAGE TEST MANUALLY

Manual operation refers to use of the unit by operating it through the control panel and buttons located in its front panel. When operating the unit, bear in mind that during testing the high voltage connectors are live with dangerous voltage. This instruction applies to operating the unit manually by means of buttons, fly wheel knob and display located in the front panel.

4.1 Connecting to the DUT

There are three high voltage sockets in back panel. High voltage outputs are two connectors in rear side. The connections to the DUT are made according to the below figure:

4.2 Shield connection

"Shield" –connection can be used for protection against electrical noise. Connected shield (assuming that shielded cable is used) reduces measurement errors, which can be caused by cables, line noise or some other leakage currents. If you suspect measurement errors, use shielded cable and connect shield to the respective place in the unit. The shield of the LOWER connector must be connected to the SHIELD- connector at the back panel. Cables and connectors must be specified to high voltage use.

Please see the next picture for connection recommendations.

CHAPTER IV - HIGH VOLTAGE

4.3 Mains supply and switching on Quanti

Connect the Quanti device to the mains supply in the following order:

• Check that the position of the front panel POWER switch is 0
• Connect the test cables to the Quanti
• Plug the mains cord to the Quanti
• Plug the mains cord to a mains outlet
• Switch ON the Quanti

Extensive help windows, which provide the user additional information about the particular function, can be seen when "SHOW HELP" button is pressed.

4.4 Setting up an HV test

After pressing the power button Finero's logo will be displayed.

SELF TEST

After initialization the **SELF TEST** is shown. It contains configuration information and results of the diagnostics. Pressing the *"CONTINUE"* button takes you further. If the **SELF TEST** gives several errors, please contact Finero's service.

MAIN MENU

Quanti is capable of performing the High Voltage (HV) test as single-step test or as a part of test program. The Paragraphs 4.5 - 4.7 describe how the single-step test is done. Refer to **chapter IX, page 41** for conducting a test program.

On the **MAIN MENU** screen, press the *"MEASURE"* button.

The **SELECTED STEP SETTINGS** screen will now appear.

4.5 Editing HV test settings
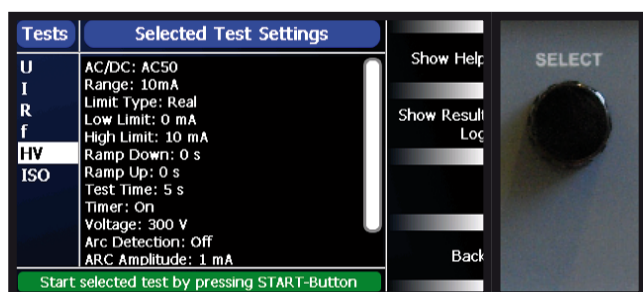
SELECTED TEST SETTINGS

On the **SELECTED TEST SETTINGS** screen, turn the fly wheel knob to highlight the High Voltage (HV) test to be conducted. After highlighting, press the fly wheel knob to edit the test settings.

Settings are edited by first highlighting the desired setting by turning the fly wheel knob and then pressing the fly wheel knob.

The table below explains how the different HV test settings can be edited.

SETTING	MEANING
AC/DC	Here you can select AC or DC test output. NOTE: The range and limits might change.
Voltage	Selects voltage to be used in the test. Range: 50 - 1000V AC/DC. Resolution: 5V.
Ramp Up	This setting modifies the voltage rise time from 0 to user-defined test voltage. If rise time is set to 0 the user-defined test voltage level is set directly. Range: 0 - 99.9sec. Resolution: 0.1sec.
Ramp Down	This setting modifies the voltage lowering time from user defined test voltage to 0. If lowering time is set to 0 the voltage level is set directly. Range: 0 - 99.9sec. Resolution: 0.1sec.
Timer	Selects if user set test time is used or if user input is needed to stop testing.
Test Time	Actual measurement time. The time the selected voltage level will be kept on object being tested. Range: 0.3 - 99.9sec. Resolution: 0.1sec.
Range	Selects measurement range for test. Options depend on AC / DC selection. DC: 1mA or 10mA, AC: 10mA or 40/100mA (depending on the device configuration).
Limit Type	Selects limits to apply to real or total current values.
High Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: 0 - Range Max. Resolution: When range is 1mA = 0.0001mA, otherwise = 0.001mA.
Low Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. If limit is set to 0, limit will not be used. If Low Limit is set higher than High Limit, Quanti will give a warning message. Range: 0 - Range Max. Resolution: When range is 1mA = 0.0001mA, otherwise = 0.001mA.
ARC Detection*	Selects if Arc detection is used for pass/fail parameter.
ARC Amplitude	Amplitude level for Arc detection. Range: 1 - 20mA, Resolution: 1mA.
ARC Width	Arc Width for Arc Detection. If set to 0 will detect <5 μs arcs. Range: 5 - 100 msec. Resolution: 1msec.
Connectivity **	Selects whether Connectivity test is used or not. Please see the explanation below.
Connectivity limit	Sets minimum current that has to be reached to ensure connectivity. Range: 1 - 999μA. Resolution: 1μA.
Connectivity AC voltage	Sets AC voltage to be used for connectivity test. Please note this is only used for DC test with Ramp Up set to 0s. Range: 50 - 1000VAC. Resolution: 5V.

*Arc detection - Arc is electrical spark occurred by voltage or current quickly changing. There should be no "sparking" in a High Voltage test. Arc detection can help you to solve product quality issues.

** Connectivity

IF AC 50 or 60 voltage is selected:

Connectivity test limit - If REAL CURRENT > CONNECTIVITY LIMIT, connection is OK.
If connectivity test is chosen, the comparison takes place when test voltage is reached.

IF DC voltage is selected AND RAMP UP is set to 0:

If connectivity test is chosen with these settings, short AC voltage test is conducted before DC high voltage test. Connectivity AC voltage will be used for this test. If REAL CURRENT > CONNECTIVITY LIMIT, connection is OK.

IF DC voltage is selected AND RAMP UP is set to > 0: AC current generated while rising DC test voltage will generate AC current. This test checks if real component of this current stays above connectivity limit for at least 0.1T of the ramp up time. Please NOTE: Connectivity AC voltage setting is not used for this test.

NOTICE! FALSE USE OF THIS TEST CAN CAUSE DAMAGE TO DUT (Device Under Test).

START THE TEST BY PRESSING THE START BUTTON IN THE FRONT PANEL.

4.6 HV test screen
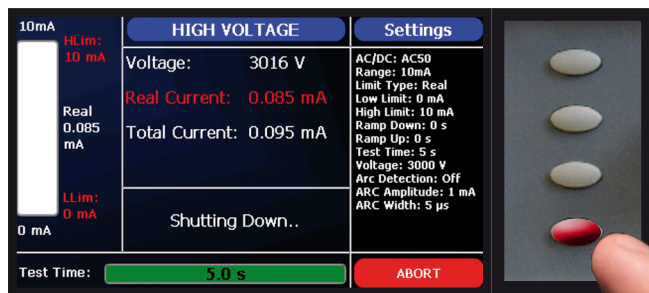
HV TEST SCREEN

After the test has started, the HV test screen is shown on the display during the test time.

The test can be aborted by pressing the *"ABORT"* button.

4.7 Test result screen

After the test is done, the test result appears on the screen. The test result is either **PASSED** or **FAILED**:

PASSED SCREEN

When DUT passed the test and the test process is completed, the green led will light on the front panel and the display will show the results of the test as seen on the left.

FAILED SCREEN

When DUT fails the test and the test process is completed, an alarm will sound (if alarm sound setting is ON) together with the red led lighting on the front panel and the display will show the cause of the failure of the test as seen on the left.

By pressing the fly wheel knob the while on the **PASSED / FAILED** screen, takes you back to the **SELECTED TEST SETTINGS VIEW**.

CHAPTER V - INSULATION RESISTANCE

1. GENERAL INFORMATION

The objective of the Insulation Resistance (ISO) test is to measure the total **resistance** between any two points separated by **insulation**. The test, therefore, determines how effective the insulation is in resisting the flow of electrical **current**.

Insulation resistance test consists in measuring the insulation resistance of a **Device Under Test (DUT)**, while **phase** and neutral are short circuited together. The measured resistance has to be higher than the indicated limit from the international standards.

The insulation resistance test can be applied to both **Class I** and **Class II** equipment. It is carried out with the use of probes or insulated clips, without the equipment being connected to a power supply. Test voltages vary between standards; the most common application called for is 500 V. The **voltage** is applied for 2 to 3 seconds. In general, Class I equipment must display a resistance greater than 2 MΩ to pass the test. Resistance greater than 7 MΩ is required for Class II equipment.

During insulation resistance test **DC** voltage is applied across a **dielectric**, measuring the amoung of current flowing through that dielectric, and then calculating a resistance measurement. The resistance measurement is in megohms.

Insulation resistance can be used as:

• A quality control measure at the time a piece of electrical equipment is produced
• An installation requirement to help ensure specifications are met and to verify proper hookup
• A periodic preventive maintenance task
• A troubleshooting tool

2. INSULATION RESISTANCE SPECIFICATIONS

INSULATION RESISTANCE FUNCTION SPECIFICATIONS	
OUTPUT VOLTAGE	**Range: 50 - 1000V DC** **Resolution: 1V** **Accuracy: ± 0.5% of range**

RESISTANCE MEASUREMENT	**Range: 0.5MΩ - 50 000MΩ (5 digit, Auto range)**
	
	Resolution: **MΩ** **MΩ**
	
	             0.001 **0.500 - 9.999**
	             0.01 **1.00 - 99.99**
	             0.1 **10.0 - 999.9**
	             1 **100 - 50 000**
	
	Accuracy: **± 5% to ± 15% depending upon the voltage and the selected range**
	
	50 - 499V DC:
	0.5MΩ - 999.9MΩ, ± (5% of reading +2 counts)
	1000MΩ - 9999MΩ, ± (8% of reading +2 counts)
	10000MΩ - 50000MΩ, ± (17% of reading +2 counts)
	
	500 - 1000V DC:
	0.5MΩ - 999.9MΩ, ± (3% of reading +2 counts)
	1000MΩ - 9999MΩ, ± (6% of reading +2 counts)
	10000MΩ - 50000MΩ, ± (15% of reading +2 counts)

RAMP TIME	**Ramp up: 0.1 - 99.9sec; No Ramp** **Ramp down: 0.1 - 99.9sec; No Ramp**
TEST TIME	**0; 0.3 - 999.9sec (0 = continuous)**
HI AND LO LIMIT (MΩ)	**Range: 0.500 - 0.999** **Resolution: 0.001** **Range: 1.00 - 9.99** **Resolution: 0.01** **Range: 10.0 - 99.9** **Resolution: 0.1** **Range: 100 - 50 000** **Resolution: 1**
	Hi Limit: 0 = OFF

3. SAFETY

Before testing can be started, the user should become sufficiently familiar with the instructions of use and the operation of the tester. In addition, read carefully the emergency first aid instructions and the testing procedure. Only a qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury are intended to use Quanti.

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the manual.

The high voltage connectors in the rear panel have a dangerous high voltage during the test.

The current supplied by Quanti is high enough to cause convulsion and potentially to get trapped to the parts under High Voltage. Quanti measures the current in the circuit and shall switch the voltage off if the current exceeds the set current limit, **THIS FEATURE CANNOT BE USED AS A SAFETY MEASURE!**

NEVER TOUCH THE HIGH VOLTAGE CONNECTORS OR THE TEST LEADS IF QUANTI IS SWITCHED ON!

4. PERFORMING INSULATION RESISTANCE TEST MANUALLY

Manual operation refers to use of the unit by operating it through the control panel and buttons located in its front panel. When operating the unit, bear in mind that during testing the high-voltage connectors are live with dangerous voltage. This instruction applies to operating the unit manually by means of buttons and display located in the front panel.

4.1 Connecting to the DUT

There are three high voltage sockets in back panel. High voltage outputs are two connectors in rear side. The connections to the DUT are made according to the below figure:

4.2 Shield connection

"Shield" –connection can be used for protection against electrical noise. Connected shield (assuming that shielded cable is used) reduces measurement errors, which can be caused by cables, line noise or some other leakage currents. If you suspect measurement errors, use shielded cable and connect shield to the respective place in the unit. The shield of the LOWER connector must be connected to the SHIELD- connector at the back panel. Cables and connectors must be specified to high voltage use.

Please see the next picture for connection recommendations.

4.3 Mains supply and switching on Quanti

Connect the Quanti device to the mains supply in the following order:

- Check that the position of the front panel POWER switch is 0
- Connect the test cables to the Quanti
- Plug the mains cord to the Quanti
- Plug the mains cord to a mains outlet
- Switch ON the Quanti

Extensive help windows, which provide the user additional information about the particular function, can be seen when "SHOW HELP" button is pressed.

4.4 Setting up an ISO test

After pressing the power button Finero's logo will be displayed.

SELF TEST

After initialization the **SELF TEST** is shown. It contains configuration information and results of the diagnostics. Pressing the **"CONTINUE"** button takes you further. If the **SELF TEST** gives several errors, please contact Finero's service.
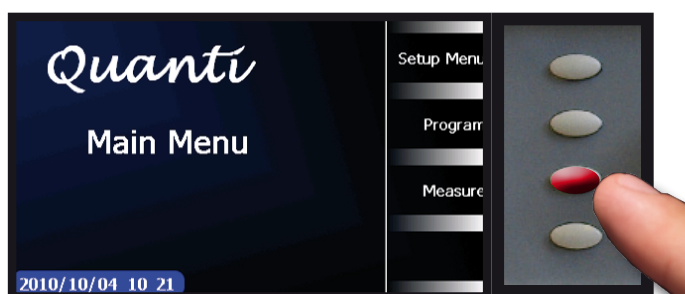
MAIN MENU

Quanti is capable of performing the Insulation resistance (ISO) test as single-step test or as a part of test program. The Paragraphs 4.5 - 4.7 describe how the single-step test is done. Refer to **chapter IX, page 41** for conducting a test program.

On the **MAIN MENU** screen, press the **"MEASURE"** button.

The **SELECTED STEP SETTINGS** screen will now appear.

4.5 Editing ISO test settings
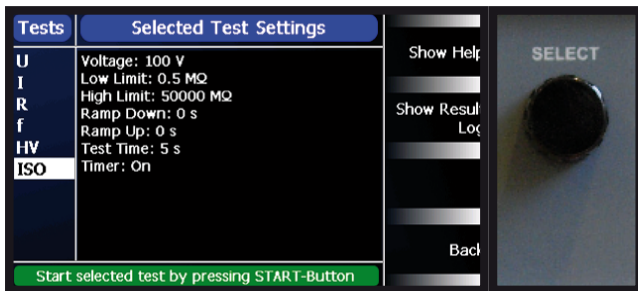
SELECTED TEST SETTINGS

On the **SELECTED TEST SETTINGS** screen, turn the fly wheel knob to highlight the Insulation Resistance (ISO) test to be conducted. After highlighting, press the fly wheel knob to edit the test settings.

Settings are edited by first highlighting the desired setting by turning the fly wheel knob and then pressing the fly wheel knob.

The table below explains how the different ISO test settings can be edited.

| SETTING	MEANING
Voltage	Sets the test voltage from 50VDC to 1000VDC. Range: 50 - 1000VDC. Resolution 5VDC.
Ramp Up	This setting modifies the voltage rise time from 0 to user-defined test voltage. If rise time is set to 0 the user-defined test voltage level is set directly. Range: 0 - 99.9sec. Resolution: 0.1sec.
Ramp Down	This setting modifies the voltage lowering time from user-defined test voltage to 0. If lowering time is set to 0 the voltage level is set directly. Range: 0 - 99.9sec. Resolution: 0.1sec.
High Limit	If the actual measurement result goes beyond the limit Quanti will give a message FAIL. If limit is set to 0, this limit will not be used. Range: 0.5 - 50000MΩ. Resolution: 0.001MΩ.
Low Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: 0.5 - 50000MΩ. Resolution: 0.001MΩ.
Timer	Selects if user set test time is used or if user input is needed to stop testing.
Test Time	Actual measurement time. The time the selected voltage level will be kept on object being tested. Range: 0.3 - 99.9sec. Resolution: 0.1sec.
Connectivity*	Selects whether Connectivity test is used or not. Please see the explanation below.
Connectivity limit	Sets minimum current that has to be reached to ensure connectivity.
Connectivity AC voltage	Sets AC voltage to be used for connectivity test. Please note this is only used for DC test with Ramp Up set to 0s. Range: 50 - 1000VAC. Resolution: 5V.

* Connectivity

IF RAMP UP is set to 0:

If connectivity test is chosen with these settings, short AC voltage test is conducted before DC high voltage test. Connectivity AC voltage will be used for this test. If REAL CURRENT > CONNECTIVITY LIMIT, connection is OK.

IF RAMP UP is set to > 0:

AC current generated while rising DC test voltage will generate AC current. This test checks if real component of this current stays above connectivity limit for at least 0.1T of the ramp up time. Please NOTE: Connectivity AC voltage setting is not used for this test.

NOTICE! FALSE USE OF THIS TEST CAN CAUSE DAMAGE TO DUT (Device Under Test).

START THE TEST BY PRESSING THE START BUTTON IN THE FRONT PANEL.
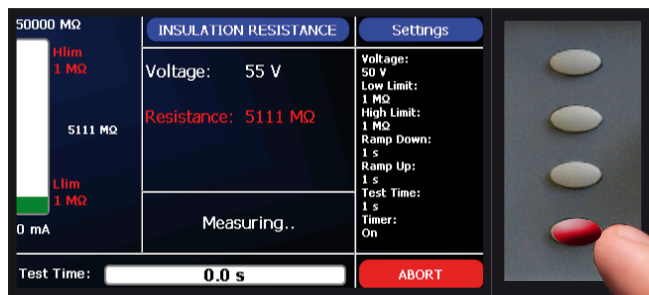
4.6 ISO test screen

ISO TEST SCREEN

After the test has started, the ISO test screen is shown on the display during the test time.

The test can be aborted by pressing the *"ABORT"* button.

4.7 Test result screen

After the test is done, the test result appears on the screen. The test result is either **PASSED** or **FAILED**:

PASSED SCREEN

When DUT passed the test and the test process is completed, the green led will light on the front panel and the display will show the results of the test as seen on the left.

FAILED SCREEN

When DUT fails the test and the test process is completed, an alarm will sound (if alarm sound setting is ON) together with the red led lighting on the front panel and the display will show the cause of the failure of the test as seen on the left.

By pressing the fly wheel knob the while on the **PASSED / FAILED** screen, takes you back to the **SELECTED TEST SETTINGS VIEW**.

CHAPTER VI - GROUND BOND

1. GENERAL INFORMATION

Ground bond (GB) test (also referred to as PE resistance test, ground continuity test) determines whether the safety ground circuit of the **Device Under Test (DUT)** can adequately handle fault **current** if the product should ever become defective.

The Low Voltage Directive **(CE Mark)** and product approval agencies stipulate that this test must be performed on 100% of all **Class I** earthed, grounded, or metal clad products produced during manufacture as part of the criteria for routine testing.

Compliance is checked by measuring the **resistance** of the connection between the protective earthing terminal or earthing contact and the parts to be earthed to ensure that resistance does not exceed certain values when subjected to a high current as specified in various product safety standards. It is important to bear in mind that from the constructional and design points of view, the protective earthing **conductors** should not contain switches or fuses.

Most safety standards require the following parameters for conducting the ground bond test:

- The DUT must be subjected to a high **AC or DC** current with a low test **voltage** for a certain period.
- The voltage drop between the protective earthing terminal or earthing contact and the part to be earthed must be measured.
- The resistance must be calculated from the current and the resulting voltage drop using **Ohm's law**.

The test ensures that the earth or ground conductor can carry sufficient current to enable the supply protective fuse in the plug top, or circuit breaker, to blow before the case rises to a hazardous voltage.

Ground bond test detects problems such as insufficient ground wire diameter, open ground circuit and loose ground screw. A failure indicates loose or poor earthing/ground connections within the Device Under Test (DUT).

2. GROUND BOND SPECIFICATIONS

GROUND BOND FUNCTION SPECIFICATIONS	
OUTPUT CURRENT	**Range:** **3.00 - 30.00A AC** **Resolution: 0.01A** **Accuracy:** **± 1% (of setting + 0.15A)**
OUTPUT FREQUENCY	**50 / 60Hz, User selectable**
RESISTANCE MEASUREMENT	**Range: 0.5mΩ - 500.0mΩ** **Resolution: 0.1mΩ** **Accuracy: 0.5% of range**
TEST METHOD	**4 wire measurement**
TEST TIME	**0; 0.3 - 999.9sec (0 = continuous)**
HI AND LO LIMIT	**Range: 0.5mΩ - 500.0mΩ** **Resolution: 0.1mΩ**
MAXIMUM LOADING	**20A 500mΩ** **25A 380mΩ** **30A 300mΩ**
CURRENT DISPLAY	**Range:** **3.00A - 30.00A** **Resolution: 0.01A** **Accuracy:** **± (1% of reading + 0.15A)**
WAVEFORM	**True Sine wave**

3. SAFETY

Before testing can be started, the user should become sufficiently familiar with the instructions of use and the operation of the tester. In addition, read carefully the emergency first aid instructions and the testing procedure. Only a qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury are intended to use Quanti.

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the manual.

The rear panel test connectors have low voltage during the test but due to high current there may occur some sparking in the test connectors. Also take care of heating of the test leads caused by high currents. Therefore use sufficient cable crosssection size for test leads.

The current supplied by Quanti is high enough to cause convulsion and potentially to get trapped to the parts under high voltage. Quanti measures the current in the circuit and shall switch the voltage off if the current exceeds the set current limit, **THIS FEATURE CANNOT BE USED AS A SAFETY MEASURE!**

NEVER TOUCH THE HIGH VOLTAGE CONNECTORS OR TEST LEADS IF QUANTI IS SWITCHED ON!

4. PERFORMING GROUND BOND TEST MANUALLY

Manual operation refers to use of the unit by operating it through the control panel and buttons located in its front panel. When operating the unit, bear in mind that during testing the high-voltage connectors are live with dangerous voltage. This instruction applies to operating the unit manually by means of buttons and display located in the front panel.

4.1 Connecting to the DUT

There are 4pcs of 4mm sockets in the back panel. The connections to the DUT are made according to the below figure:
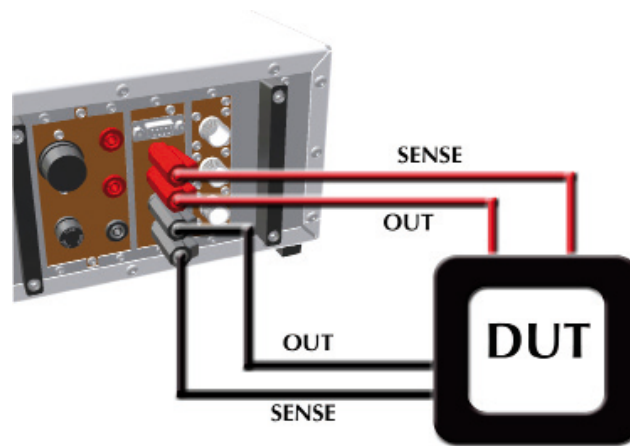
It is possible to use only 2 wires by compromising on measurement accuracy. Finero however recommends using only 4-wire measurement method.

4.2 Four wire measurement

4 wire measurement ensures accurate and repeatable measurements. When measuring low values resistances, an important error source can be found in the contact resistance. In many applications, the contact resistance value can go beyond the value which has to be measured. To cancel this error source a 4 wire measurement is used.

For instance during the day the factory ambient temperature can change, which would mean wrong resistance values with 2 wire measurements if the error is not manually and constantly offset.

4.3 Mains supply and switching on Quanti

Connect the Quanti device to the mains supply in the following order:

• Check that the position of the front panel POWER switch is 0
• Connect the test cables to the Quanti
• Plug the mains cord to the Quanti
• Plug the mains cord to a mains outlet
• Switch ON the Quanti

Extensive help windows, which provide the user additional information about the particular function, can be seen when "SHOW HELP" button is pressed.

4.4 Setting up a GB test

After pressing the power button Finero's logo will be displayed.
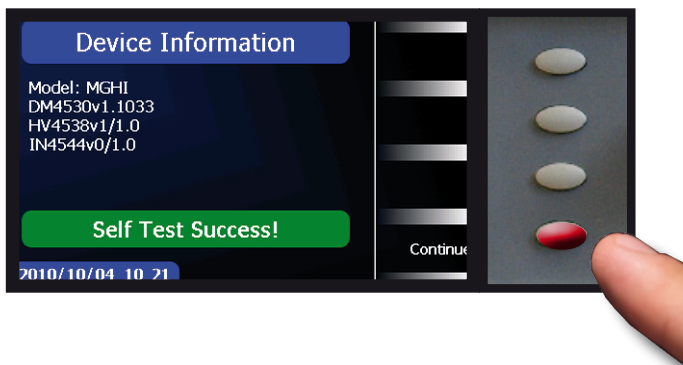
SELF TEST

After initialization the **SELF TEST** is shown. It contains configuration information and results of the diagnostics. Pressing the *"CONTINUE"* button takes you further. If the **SELF TEST** gives several errors, please contact Finero's service.

MAIN MENU

Quanti is capable of performing the Ground bond test as single-step test or as a part of test program. The Paragraphs 4.5 - 4.7 describe how the single-step test is done. Refer to **chapter IX, page 41** for conducting a test program.

On the **MAIN MENU** screen, press the *"MEASURE"* button.

The **SELECTED STEP SETTINGS** screen will now appear.

4.5 Editing GB test settings
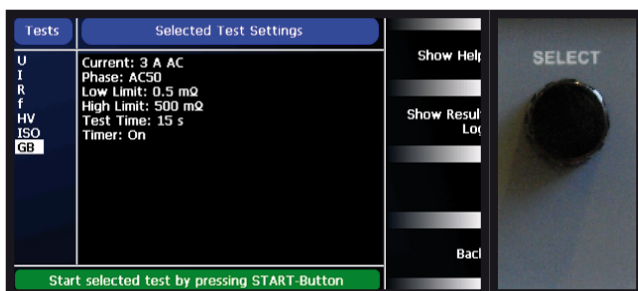
SELECTED TEST SETTINGS

On the **SELECTED TEST SETTINGS** screen, turn the fly wheel knob to highlight the Ground Bond (GB) test to be conducted. After highlighting, press the fly wheel knob to edit the test settings.

Settings are edited by first highlighting the desired setting by turning the fly wheel knob and then pressing the fly wheel knob.

Pressing the *"SHOW HELP"* button shows help for steps or selected setting.

CHAPTER VI - GROUND BOND

The table below explains how the different GB test settings can be edited.

SETTING	MEANING
Current	Sets the measurement AC current. Range: 3 - 30A. Resolution: 0.01A.
Frequency	Selects AC50 or AC60 voltage frequency to be used in the test.
High Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: 0.5 - 500mΩ. Resolution: 0.01mΩ.
Low Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. If limit is set to 0, this limit will not be used. Range: 0.5 - 500mΩ. Resolution: 0.01mΩ.
Timer	Selects if user set test time is used or if user input is needed to stop testing.
Test time	Selects time to apply voltage to object being tested. Range: 0.3 - 99.9sec. Resolution: 0.1sec.

START THE TEST BY PRESSING THE START BUTTON IN THE FRONT PANEL.

4.6 GB test screen
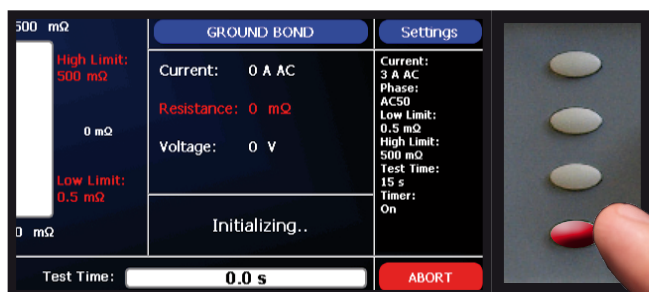
GB TEST SCREEN

After the test has started, the GB test screen is shown on the display for the test time.

The test can be aborted by pressing the *"ABORT"* button.

4.7 Test result screen

After the test is done, the test result appears on the screen. The test result is either **PASSED** or **FAILED**:

PASSED SCREEN

When DUT passed the test and the test process is completed, the green led will light on the front panel and the display will show the results of the test as seen on the left.

FAILED SCREEN

When DUT fails the test and the test process is completed, an alarm will sound (if alarm sound setting is ON) together with the red led lighting on the front panel and the display will show the cause of the failure of the test as seen on the left.

By pressing the fly wheel knob the while on the **PASSED / FAILED** screen, takes you back to the **SELECTED TEST SETTINGS VIEW**.

CHAPTER VII - DMM

1. GENERAL INFORMATION

DMM (Digital multimeter) usually combines several measurement functions in one unit. A typical multimeter may include features such as the ability to measure **voltage**, **current** and **resistance**. In a digital multimeter the signal under test is converted to a voltage and an amplifier with electronically controlled gain preconditions the signal. A digital multimeter displays the quantity measured as a number.

2. DMM SPECIFICATIONS

DMM FUNCTION SPECIFICATIONS			
MEASUREMENT FUNCTION	**RANGE**		**ACCURACY % OF RANGE**
VOLTAGE DC	100mV 1V 10V 100V 1000V		0.025
RESISTANCE 2 WIRE	100Ω		0.05
	1kΩ		0.05
	10kΩ		0.05
	100kΩ		0.05
	1MΩ		0.1
	10MΩ		0.25
	100MΩ		2.5
CURRENT DC	10mA 100mA 1A 10A		0.1
10Hz - 120kHz VOLTAGE AC TRMS	100mV 1V 10V 100V 750V	10Hz - 50Hz	1
		50Hz - 100Hz	0.5
		100Hz - 25kHz	0.25
		25kHz - 120kHz	1
20Hz - 5kHz CURRENT AC TRMS	10mA 100mA 1A 10A		0.5
FREQUENCY	**PERIOD RANGE**		**% OF RANGE**
3Hz - 500kHz (For 0.1V - 750V AC RMS)	333msec - 2μsec		0.01%

The current measurement with a current transformer is only allowed with external shunt in voltage measurement mode!

3. SAFETY

Before testing can be started, the user should become sufficiently familiar with the instructions of use and the operation of the tester. In addition, read carefully the emergency first aid instructions and the testing procedure. Only a qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury are intended to use Quanti.

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the manual.

Do NOT touch under no circumstances the alligator clips when the equipment output voltage is switched on

Do NOT connect under no circumstances to the DMM inputs any over 1000V

4. PERFORMING DMM TEST MANUALLY

Manual operation refers to use of the unit by operating it through the control panel and buttons located in its front panel. When operating the unit, bear in mind that during testing the high-voltage connectors are live with dangerous voltage. This instruction applies to operating the unit manually by means of buttons and display located in the front panel.

4.1 Connecting to the DUT

The connections to the DUT are made according to the below figure:

RESISTANCE
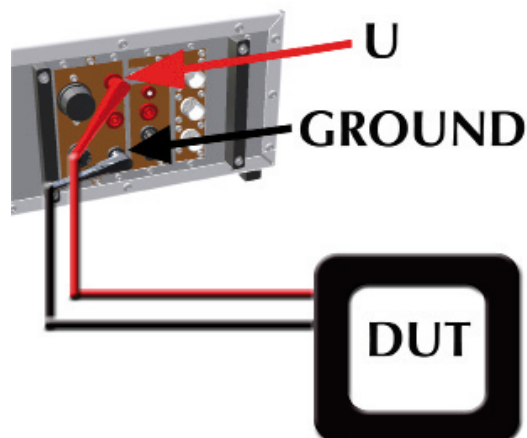
VOLTAGE
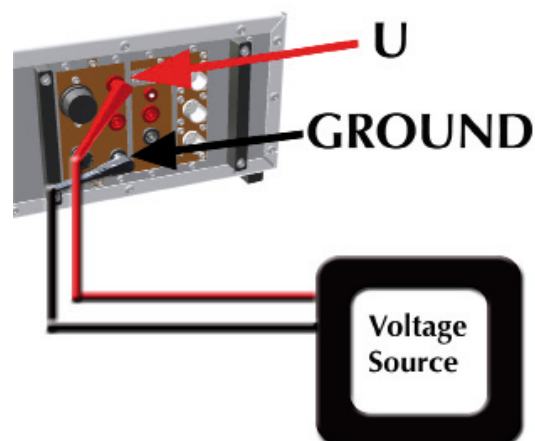
CURRENT
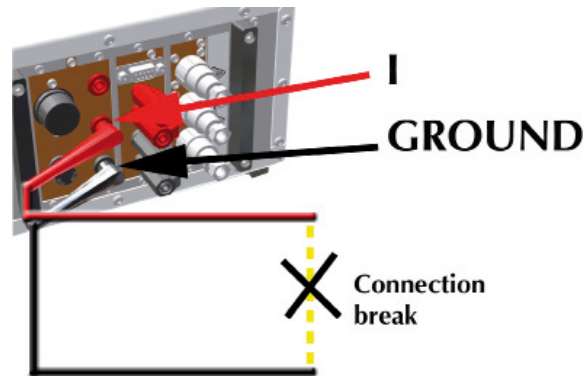
4.2 Mains supply and switching on Quanti

Connect the Quanti device to the mains supply in the following order:

- Check that the position of the front panel POWER switch is 0
- Connect the test cables to the Quanti
- Plug the mains cord to the Quanti
- Plug the maisn cord to a mains outlet
- Switch ON the Quanti

Extensive help windows, which provide the user additional information about the particular function, can be seen when "SHOW HELP" button is pressed.

4.3 Setting up a DMM test

After pressing the power button Finero's logo will be displayed.
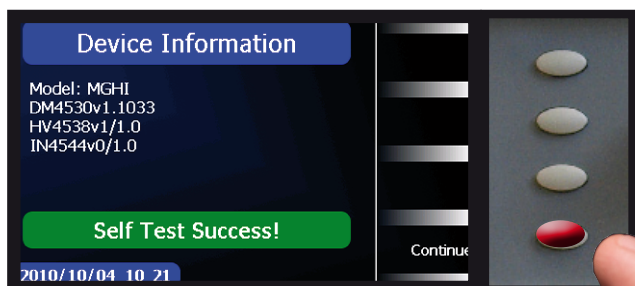
SELF TEST

After initialization the **SELF TEST** is shown. It contains configuration information and results of the diagnostics. Pressing the *"CONTINUE"* button takes you further. If the **SELF TEST** gives several errors, please contact Finero's service.

MAIN MENU

Quanti is capable of performing the DMM tests as single-step tests or as a part of test program. The Paragraphs 4.4 - 4.6 describe how the single-step test is done. Refer to **chapter IX, page 41** for conducting a test program.

On the **MAIN MENU** screen, press the *"MEASURE"* button. The **SELECTED STEP SETTINGS** screen will appear as follows:

4.4 Editing DMM test settings
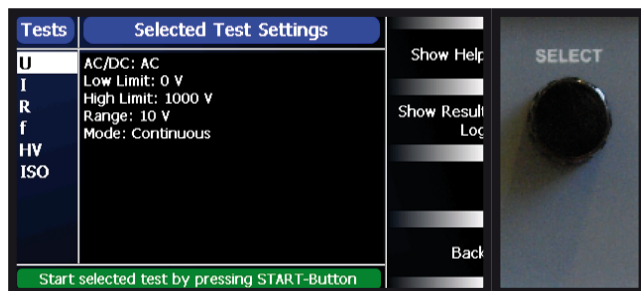
SELECTED TEST SETTINGS

On the **SELECTED TEST SETTINGS** screen, turn the fly wheel knob to highlight the type of DMM test (U, I, R or f) to be conducted. After highlighting, press the fly wheel knob to edit the test settings.

Settings are edited by first highlighting the desired setting by turning the fly wheel knob and then pressing the fly wheel knob.

Pressing the *"SHOW HELP"* button shows help for steps or selected setting.

The following tables explain how the different DMM test settings can be edited.

4.4.1 Editing DMM voltage settings

SETTING	MEANING
AC/DC	Selects AC or DC current for measurement.
Range	Selects range for measurement, same functionality as regular multimeter.
Mode	Measure continuously or do single measurements.
Limits	Selects if lmits should be used in the test.
High Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: -1000 - 1000 mV / V . Resolution: 0.001 mV / V.
Low Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: -1000 - 1000 mV / V . Resolution: 0.001 mV / V.

START THE TEST BY PRESSING THE START BUTTON IN THE FRONT PANEL.

4.4.2 Editing DMM current settings

SETTING	MEANING
AC/DC	Selects AC or DC current for measurement.
Range	Selects range for measurement, same functionality as regular multimeter.
Mode	Measure continuously or do single measurements.
Limits	Selects if lmits should be used in the test.
High Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: -1000 - 1000 mA / A . Resolution: 0.001 mV / V.
Low Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: -1000 - 1000 mA / A . Resolution: 0.001 mV / V.

START THE TEST BY PRESSING THE START BUTTON IN THE FRONT PANEL.

4.4.3 Editing DMM resistance settings

SETTING	MEANING
Range	Selects range for measurement, same functionality as regular multimeter.
Mode	Measure continuously or do single measurements.
Limits	Selects if lmits should be used in the test.
High Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: -1000 - 1000 Ω / kΩ / MΩ. Resolution: 0.001 Ω / kΩ / MΩ.
Low Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: -1000 - 1000 Ω / kΩ / MΩ. Resolution: 0.001 Ω / kΩ / MΩ.

START THE TEST BY PRESSING THE START BUTTON IN THE FRONT PANEL.

4.4.4 Editing DMM frequency settings

SETTING	MEANING
Range	Selects range for measurement, same functionality as regular multimeter.
Mode	Measure continuously or do single measurements.
Limits	Selects if lmits should be used in the test.
High Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: -1000 - 1000 Hz / kHz. Resolution: 0.001 Hz / kHz.
Low Limit	If the actual measurement result goes beyond the limit, Quanti will give a message FAIL. Range: -1000 - 1000 Hz / kHz. Resolution: 0.001 Hz / kHz.

START THE TEST BY PRESSING THE START BUTTON IN THE FRONT PANEL.

4.5 DMM test screen

DMM TEST SCREEN

After the test has started, the DMM test screen with relevant information about currently running DMM test is shown on the display for the test time.

The test can be aborted by pressing the *"ABORT"* button.

4.6 Test result screen

After the test is done, the test result appears on the screen. The test result is either **PASSED** or **FAILED**:

PASSED SCREEN

When DUT passed the test and the test process is completed, the green led will light on the front panel and the display will show the results of the test as seen on the left.
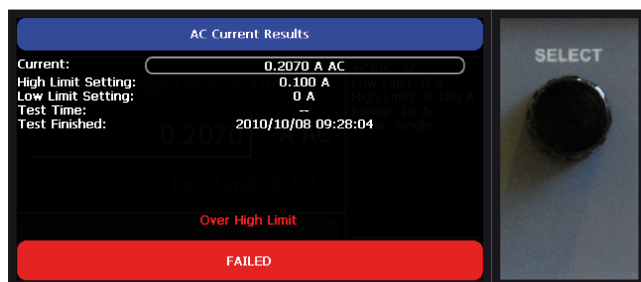
FAILED SCREEN

When DUT fails the test and the test process is completed, an alarm will sound (if alarm sound setting is ON) together with the red led lighting on the front panel and the display will show the cause of the failure of the test as seen on the left.

By pressing the fly wheel knob the while on the **PASSED / FAILED** screen, takes you back to the **SELECTED TEST SETTINGS VIEW**.

CHAPTER VIII - SYSTEM SETUP

1. SYSTEM SETUP
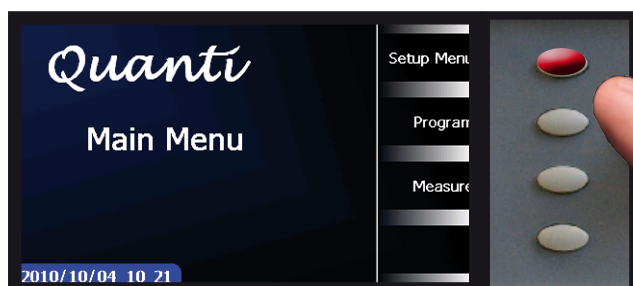
MAIN MENU

From the **MAIN MENU** continue by pressing *"SETUP MENU"*.
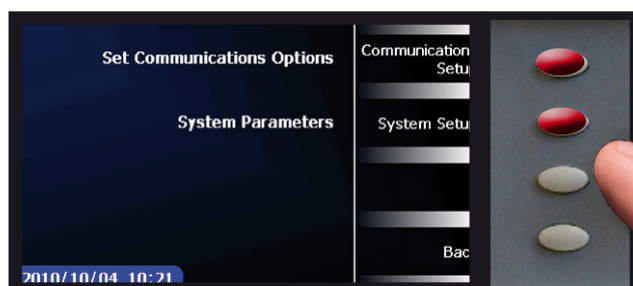
SETUP MENU

In the **SETUP MENU** you can choose to go either to "**COMMUNICATION SETUP**" or "**SYSTEM SETUP**". *"BACK"* button takes you back to main menu view.

1.1 Communications setup
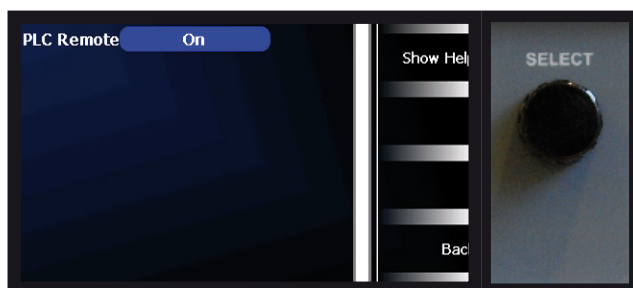
COMMUNICATIONS SETUP

In the **COMMUNICATIONS SETUP** you can connect the PLC remote ON of OFF by using the fly wheel knob. Pressing the *"SHOW HELP"* button shows the help screen for selected setting. *"BACK"* button takes you back to **SETUP MENU**.

Please also see the Chapter X, PLC REMOTE, page 43.

1.2 System setup settings
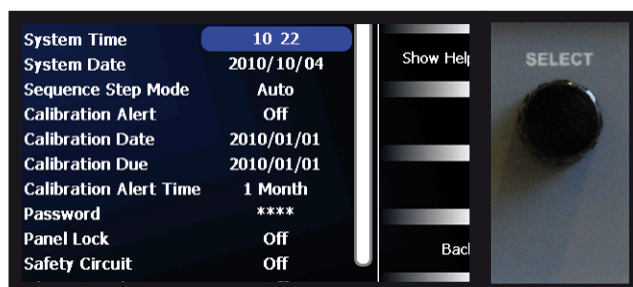
SYSTEM SETUP SETTINGS

In the **SYSTEM SETTINGS** you can choose the system settings to be edited. Turn the fly wheel knob to highlight the desired setting. After highlighting press the fly wheel knob to edit the setting. Pressing the *"SHOW HELP"* button shows the help screen for selected setting. Pressing the *"BACK"* button takes you back to **SETUP MENU**.

CHAPTER VIII - SYSTEM SETUP

The table below clarifies the meaning of different system setup settings.

SETTING	MEANING
System Time	This setting modifies system time on onboard Real-Time Clock Circuit (RTC).
System Date	This setting modifies system date on onboard Real-Time Clock Circuit (RTC).
Language*	Select your language: DE for German, FR for French, ES for Spanish, EN for English.
Sequence Step Mode	Selects the mode for running sequences. In single mode the user has to start all tests invidually. In auto mode whole sequence is ran without any input from user.
Calibration Alert	The equipment gives you an alert if this is ON.
Calibration Date	Here you can set the last calibration date.
Calibration Due	Here you can set the next date when this Quanti device should be calibrated again.
Calibration Alert Time	Here you can set the time how much in advance Quanti should alert that it needs to get calibrated.
Password **	Set a password for Quanti. NOTE: Default password is "quanti"
Panel Lock	Locks the Quanti user interface until password is given. PC Communications work normally.
Safety Circuit Mode	Sets PLC Remote Safety Circuit feature ON or OFF.
Alarm Sound	Sets alarm sound feature ON or OFF.

* IF LANGUAGE IS CHANGED:

Quanti has to be manually restarted.

** IN CASE PASSWORD IS FORGOTTEN:

"quanti" (in lower case letters) is the override password. Regardless of the user set password, if password is asked and the user types **"quanti"**, the password is automatically reset to **"quanti"**.

CHAPTER IX - PROGRAM MENU

1. PROGRAM MENU
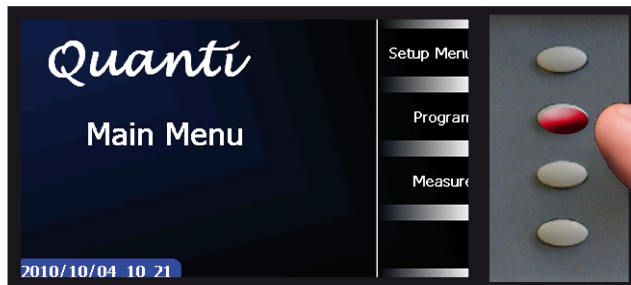
MAIN MENU

From the **MAIN MENU** continue by pressing *"PROGRAM"*.
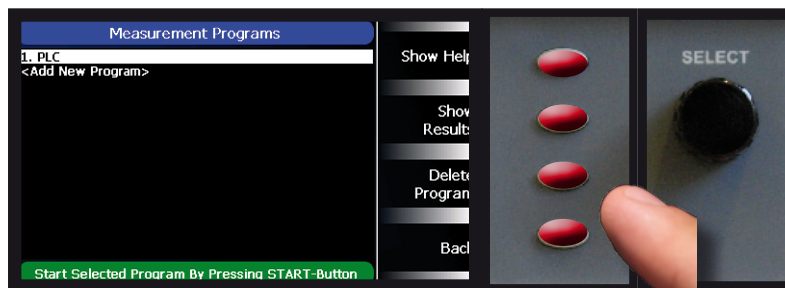
PROGRAM MENU

In the **PROGRAM MENU** you can run predefined measurement programs or modify them or define new programs. Turn the fly wheel knob to highlight the desired program selection. After highlighting, press the fly wheel knob to edit the measurement program step settings.

"SHOW RESULTS" button shows the result of previously conducted measurement programs.

"DELETE PROGRAM" button deletes the highlighted measurement program.

Pressing the *"BACK"* button takes you back to **MAIN MENU**.

First measurement program is always PLC remote program, which cannot be deleted. Setting the PLC remote start signal high will always run this measurement program. If run from this menu or from program step editing menu it will be run as regular program. ()

1.1 Program step editor menu
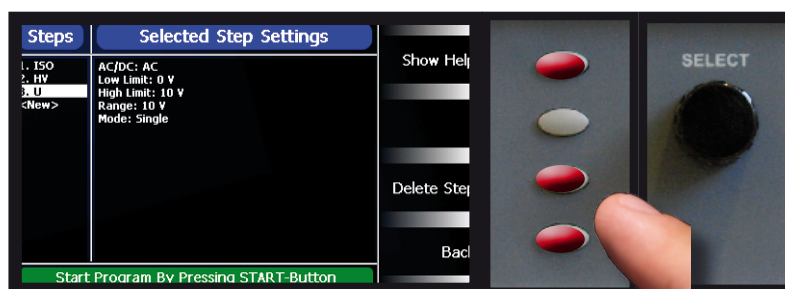
PROGRAM STEP EDITOR MENU

In the **PROGRAM STEP EDITOR MENU** you can add, delete and modify measurement program steps (tests). You can also run the programs by pressing the *"START"* button.

Turn the fly wheel knob to highlight the desired program selection. After highlighting press the fly wheel knob to edit the measurement program step settings.

Pressing the *"SHOW HELP"* button shows help for steps or selected setting.

"DELETE STEP" button deletes the highlighted step (test). Pressing the *"BACK"* button takes you back to **PROGRAM MENU**.

PRESSING START BUTTON IN THE FRONT PANEL INITIALIZES CURRENTLY SELECTED MEASUREMENT PROGRAMS.

CHAPTER IX - PROGRAM MENU

1.2 Running tests in sequence

RUNNING SEQUENCE

During running measurement program the selected tests will be conducted and the passed and failed information is shown on the screen.

Pressing the *"ABORT"* button interrupts measurement program.
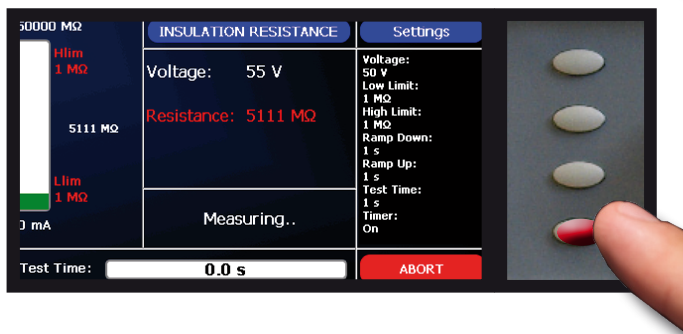
TEST VIEW

An example of ISO test view during measurement program.

Pressing the *"ABORT"* button interrupts measurement program.
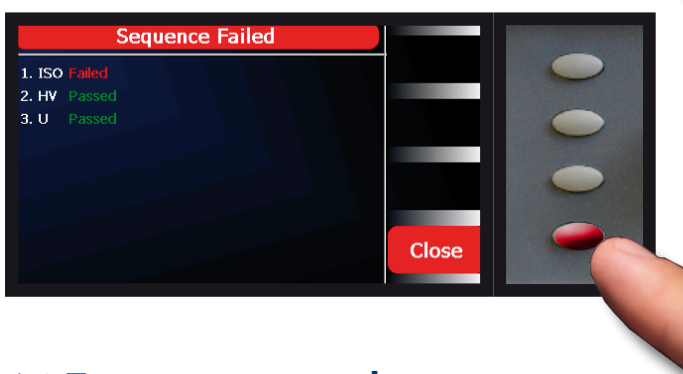
TEST RESULT VIEW

Pressing the *"CLOSE"* button takes you back to **PROGRAM MENU.**

1.3 Test sequence results
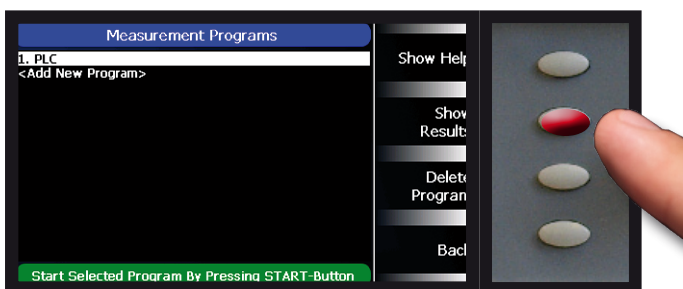
MEASUREMENT PROGRAMS

For more details about conducted measurement program results can be viewed in program result menu by pressing the *"SHOW RESULTS"* button.

Pressing the *"BACK"* button takes you back to **PROGRAM MENU**.
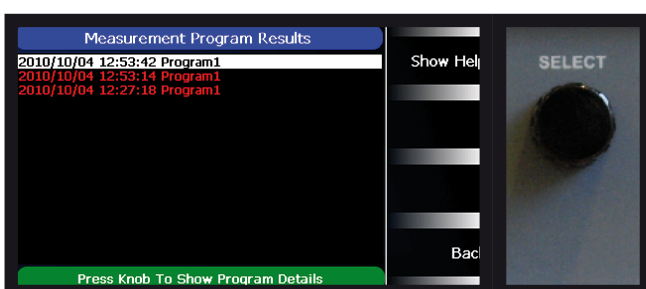
MEASUREMENT PROGRAM RESULTS

By first higlighting and then pressing the knob user can get detailed information about the program steps.

Pressing the *"BACK"* button takes you back to **PROGRAM MENU**.

FINERO *The Quality Control Company*

CHAPTER X - PLC REMOTE

1. GENERAL

PLC remote enables to incorporate Quanti device in less sophisticated automatic test systems. Quanti operates as in the manual mode but has a provision for extra output contacts for indicators and logic inputs for the control buttons.

2. START-UP

Basically Quanti will be put into operation as in manual mode. In addition the wiring of the operator connector at the back panel has to be done. The connector is a 25-pin D-type female connector. Please also see page 5, External Safety Circuit.

D25 Connector
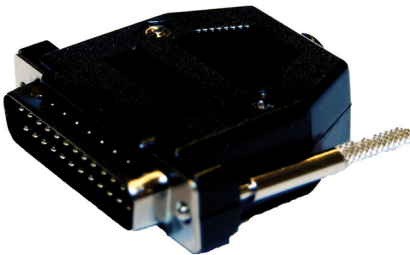
Connections of D25 Connector

X2-5 – X2-9	+ 25V
X2-22	INPUT 1
X2-10	START
X2-23	INPUT2
X2-11	STOP
X2-1	SAFETY CIRCUIT
X2-3	DISCHARGE
X2-2	TEST ON
X2-4	FAULT
X2-24	OUTPUT1
X2-25	OUTPUT2
X2-17 – X2-27	0V
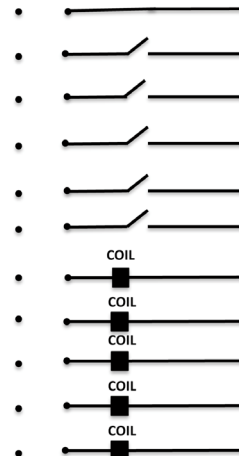
CONNECTIONS OF D25 CONNECTOR	
+25V	Constant voltage present 25 VDC
INPUT 1	Input pin state can be read by PC remote. NOTE: If GB test is present on the device this pin will be used as start signal for GB test. If Finero's PE - probe is present, the state of its trigger can be read from this pin.
START	Signal starts PLC sequence in high speed mode (no graphics) if MAIN MENU is viewed at the same time. This signal will be intrepreted as pressing the start button if the user is in measure or program menu.
INPUT 2	Input pin state can be read by PC remote.
STOP	Signal aborts running PLC sequence as if "ABORT" button is pressed.
SAFETY CIRCUIT	If 25 V is not present on safety circuit pin, no test can be run.
DISCHARGE	Indicates that no voltage is present on test output(s)
TEST ON	Indicates that a test is running
FAULT	Indicates that last test run has failed
OUTPUT 1	PC remote programmable output pin
OUTPUT 2	PC remote programmable output pin
0V	Ground pins

3. USING PLC REMOTE

3.1 Automation

If you wish to use Quanti as a part of simple automated test system, you can run tests straight after power up of self test has finished. With start signal you can start action determined in communications setup

PLC Signal Functionality
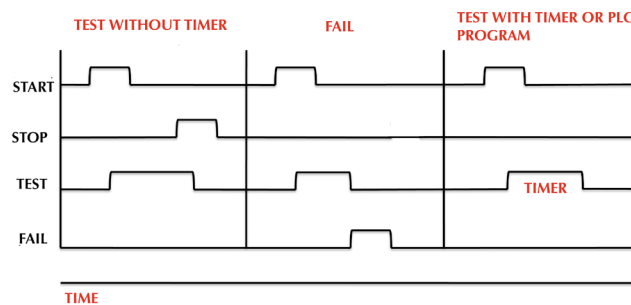
The Diagram above shows the functionality of the PLC signals during tests. The test on light will indicate that the test is running. If the test fails, running of the test will automatically end regardless of timer setting and the fail signal will be high. If the fail signal is low when the test signal goes low the test is **PASSED**. This applies to both visual and high-speed tests.

3.2 Manual Use

The start and stop signals function as pressing the "START" and "STOP" buttons while in program or measurement menus, so they can be used to implement external start and stop buttons. You can also connect test and fail signals to external lights or any kind of external indication devices (e.g. lights or audio devices).

CHAPTER XI - PC REMOTE

1. CONNECTIONS

Connection specifications for USB, ETHERNET, RS-232, GPIB can be found as separate documents, which are delivered with Quanti device.

2. PROTOCOL

Quanti takes commands in regular ASCII encoding.

2.1 Command Frame

Command frame consists of Quanti-Link Address of the device that you wish to control. Target, which is either an invidual test on the device or general settings or functions of the device. There can be several commands on a single frame excluding queries and starting and shutting down tests. There can be only 1 target per frame, e.g. if you wish to change settings of HV and GB tests you have to send 2 different frames.

QUANTI LINK ADDRESS	TARGET	CMD	END
Q0;	HV;	Volt 50;	LF (=0x0A, NL line feed, new line)

EXAMPLE COMMANDS

QUANTI LINK ADDRESS	TARGET	CMD	CMD		CMD	END
Q0;	HV;	VOLT 50;	TIMER ON;	TIME 10;	ON;	LF
Q5;	GB;	CURR 5.01;				
Q31;	HV;	CVAC 50;				
Q0;	GEN;	IDN?				
Q0;	HV;	OFF;				

Command frame must always have QUANTI-Link address and TARGET indicators in it. All commands and adress and test values must end with ";". When modifying settings, "SPACE" is used to separate setting indicator and value.

Quanti device will answer either "OK" "ERR xx" or if the command was query ("xxx?") it will answer with either queried information or "ERR xx" msg. Please see the error codes in the .

"ON" COMMAND FOR TESTER MUST ALWAYS BE THE LAST COMMAND IN A FRAME, WITH 0 TO N AMOUNT OF TESTER SETTING COMMANDS. THIS COMMAND IS SHARED BY ALL TESTERS FOR STARTING TESTS.

"OFF" COMMAND AND COMMANDS ASKING FOR INFORMATION(QUERIES, "XXX?") MUST ALWAYS BE THE ONLY COMMAND IN A FRAME. MULTIPLE QUERIES IN SAME FRAME ARE NOT ALLOWED.

NOTE! IF ANY COMMAND IN FRAME HAS ERROR, WHOLE FRAME WILL BE DISCARDED!

ANSWER	MEANING
OK	COMMANDS EXECUTED NORMALLY
ERR CODE	ERROR HAS OCCURRED IN PROCESSING THE COMMAND. "CODE" VALUE ENCODING BELOW
XX XXX	IF QUERIED FOR SPECIFIC VALUE, ANSWER WILL BE EITHER ERR XX (CODE) OR THE QUERIED ANSWER

NOTE! ANSWER TO XXX? (QUERY) WILL BE QUERY SPECIFIC ANSWER OR ERROR CODE. "OK" WILL NOT BE TRANSMITTED IN CASE OF QUERY.

2.2 Error Codes

ERROR CODE	ERROR	DETAILS
ERR 1	Command Order Error	"ON" or "OFF" commmand not last command in sent Command Frame
ERR 2	Command Syntax Error	Command syntax is not correct
ERR 3	Device Not Ready	Device is not ready to handle commands(either booting or in manual use)
ERR 4	Invalid AAMP value	Invalid value for Arc Amplitude setting
ERR 5	Invalid ACDC value	Invalid value for ACDC setting
ERR 6	Invalid ADET value	Invalid value for Arc Detection setting
ERR 7	Invalid AWID value	Invalid value for Arc width setting
ERR 8	Invalid CLIM value	Invalid value for Connectivity Limit setting
ERR 9	Invalid Command	Syntax correct but command not recognised
ERR 10	Invalid CON value	Invalid value for Connectivity setting
ERR 11	Invalid CURR value	Invalid value for Current setting
ERR 12	Invalid CVAC value	Invalid value for Connectivity Ac Voltage setting
ERR 13	Invalid FREQ value	Invalid value for Frequency setting
ERR 14	Invalid HLIM and LLIM values	Low limit value higher than High limit which would cause test to constantly fail
ERR 15	Invalid HLIM value	Invalid value for High Limit setting
ERR 16	Invalid LIMS value	Invalid value for Limits setting
ERR 17	Invalid LLIM value	Invalid value for Low Limit setting
ERR 18	Invalid LTYPE value	Invalid value for Limit Type setting
ERR 19	Invalid MODE value	Invalid value for Mode setting
ERR 20	Invalid OUT1 value	Invalid value for PLC Remote out1 pin
ERR 21	Invalid OUT2 value	Invalid value for PLC Remote out2 pin
ERR 22	Invalid Query	Query syntax ok but command not recognized
ERR 23	Invalid RAMPD value	Invalid value for Ramp Down setting
ERR 24	Invalid RAMPU value	Invalid value for Ramp Up setting
ERR 25	Invalid RANGE value	Invalid value for Range setting
ERR 26	Invalid TIME value	Invalid value for Time setting
ERR 27	Invalid TIMER value	Invalid value for Timer setting
ERR 28	Invalid VOLT value	Invalid value for Voltage
ERR 29	Multiple Queries in Frame	Several queries in same Command Frame are not allowed
ERR 30	No DMM Available	Dmm not available on device
ERR 31	No GB Test Available	Ground Bond test not available on device
ERR 32	No HV Test Available	High Voltage test not available on device
ERR 33	No ISO Test Available	Insulation Resistance test not available on device
ERR 34	Results not available	No remote tests have been conducted during device uptime
ERR 35	Test Running	Command not available while test running
ERR 36	Test Not Running	Caused by trying to shutdown a test that is not currently running
ERR 37	Safety Circuit	Safety Circuit open, cannot run tests.

2.3 HV Test Commands

2.3.1 HV test control commands

COMMAND	INFO
HV;	Target indicator
ON;	Must always be last command in frame
OFF;	Must always be only command in frame

2.3.2 HV test setting change commands

COMMAND	VALUE	INFO
ACDC	DC;	Selects DC mode
	AC50;	Selects AC 50 Hz mode
	AC60;	Selects AC 50 Hz mode
VOLT	50 - 6000;	Selects voltage
RAMPU	0; or 0.1 - 99.9;	selects voltage ramp up time. 0 or 0.1-99.9;
RAMPD	0; 0.1 - 99.9;	selects voltage ramp up time. 0 or 0.1-99.9;
TIMER	ON; or OFF;	selects whether test time is used or OFF; command is required to stop.
TIME	0.3 - 999.9;	selects test time
RANGE	1;	Depends on AC/DC selection. 1mA or 10mA
	2;	Depends on AC/DC selection. 10mA or 40/100mA
LTYPE	REAL; or TOTAL;	Selects current type to use for limit checking
HLIM	0 - 1.0000;	Please refer to HV-test settings, chapter X, page X for maximum value and resolution
LLIM	0 - 1.0000;	Please refer to HV-test settings, chapter X, page X for maximum value and resolution
ADET	ON; or OFF;	Sets arc detection on/off
AAMP	1- 20;	Set arc amplitude limit
AWID	0 or 5 - 100;	Sets arc width. 0 means will detect <5
CON	ON; or OFF;	Sets connectivity test on/off.
CLIM	0 - 100;	Connectivity limit setting
CVAC	50 - 1000;	Connectivity Ac voltage to be used on DC with no ramp

2.3.3 HV test setting queries

QUERY	ANSWER FORMAT
ACDC?	"DC" or "AC50" or "AC60"
VOLT?	Value in Volts, e.g. 100
RAMPU?	Value in seconds, e.g. 11.1
RAMPD?	Value in seconds, e.g. 11.1
TIMER?	"ON" or "OFF"
TIME?	Value in seconds, e.g. 11.1
RANGE?	"1" or "2"
LTYPE?	"REAL" or "TOTAL"
HLIM?	Value in mA, e.g. 11.1
LLIM?	Value in mA, e.g. 11.1
ADET?	"ON" or "OFF"
AAMP?	Value in mA, e.g. 11
AWID?	Value in microseconds, e.g. 11.1
CON?	"ON" or "OFF"
CLIM?	Value in microamps, e.g. 11
CVAC?	Value in Volts, e.g. 50
ALLSETS?	All answers separated by space in same order as above

2.3.4 HV test result queries

QUERY	INFO	ANSWER FORMAT
RESRCUR?	real current	Value in mA, e.g. 11.1
RESTCUR?	total current	Value in mA, e.g. 11.1
RESVOLT?	voltage	Value in Volts, e.g. 50
STAT?	status	Status number, e.g. 11, please below for meaning
TIM?	time	aa (0.1s resolution)
RES?		All answers separated by space in same order as above

STATUS	MEANING
0	No Errors Detected
1	Running
2	Ramp Up/Init
3	Ramp Down/Shutdown
4	Interrupted
5	Measured Current Under Low Limit
6	Measured Current Over High Limit
7	Safety Circuit Opened
8	Error - Over Range
9	Short circuit
10	Inverter shutdown failed
11	HV Measurement Shutdown Failed
12	Failed to reach test voltage. Check Connections
13	Connectivity Test Failed
14	Arc Detected

2.4 ISO Test Commands

2.4.1 ISO test control commands

COMMAND	INFO
ISO;	Target indicator
ON;	Must always be last command in frame
OFF;	Must always be only command in frame

2.4.2 ISO test setting change commands

COMMAND	VALUE	INFO
VOLT	50 - 1000;	Sets test voltage
RAMPU	0; or 0.1 - 99.9;	selects voltage ramp up time. 0 or 0.1-99.9;
RAMPD	0; 0.1 - 99.9;	selects voltage ramp up time. 0 or 0.1-99.9;
TIMER	ON; or OFF;	selects whether test time is used or OFF; command is required to stop.
TIME	0.3 - 999.9;	selects test time
LTYPE	REAL; or TOTAL;	Selects current type to use for limit checking
HLIM	0.5 - 50000;	High limit value in MΩ
LLIM	0.5 - 50000;	Low limit value in MΩ
CON	ON; or OFF;	Sets connectivity test on/off.
CLIM	0 - 100;	Connectivity limit setting
CVAC	50 - 1000;	Connectivity Ac voltage to be used on DC with no ramp

2.4.3 ISO test setting queries

QUERY	ANSWER FORMAT
VOLT?	Value in Volts, e.g. 100
RAMPU?	Value in seconds, e.g. 11.1
RAMPD?	Value in seconds, e.g. 11.1
TIMER?	"ON" or "OFF"
TIME?	Value in seconds, e.g. 11.1
HLIM?	Value in MΩ, e.g. 11.1
LLIM?	Value in MΩ, e.g. 11.1
CON?	"ON" or "OFF"
CLIM?	Value in microamps, e.g. 11
CVAC?	Value in Volts, e.g. 50
ALLSETS?	All answers separated by space in same order as above

2.4.4 ISO test result queries

QUERY	INFO	ANSWER FORMAT
RESR?	Resistance	Value in MΩ, e.g. 11.1
RESVOLT?	Voltage	Value in Volts, e.g. 50
STAT?	Status	Status number, e.g. 11, please below for meaning
TIM?	Time	aa (0.1s resolution)
RES?		All answers separated by space in same order as above

STATUS	MEANING
0	No Errors Detected
1	Running
2	Ramp Up/Init
3	Ramp Down/Shutdown
4	Interrupted
5	Measured Resistance Under Low Limit
6	Measured Resistance Over High Limit
7	Safety Circuit Opened
8	Error - Over Range
9	Short circuit
10	Inverter shutdown failed
11	ISO Measurement Shutdown Failed
12	Failed to reach test voltage. Check Connections
12	Connectivity Test Failed

2.5 GB Test Commands

2.5.1 GB test control commands

COMMAND	INFO
GB;	Target indicator
ON;	Must always be last command in frame
OFF;	Must always be only command in frame

2.5.2 GB test setting change commands

COMMAND	VALUE	INFO
CURR	3.00 - 30.00;	Sets test current
FREQ	AC50; or AC60;	Selects AC frequency for test
HLIM	0.5 - 500;	High limit value in mΩ
LLIM	0.5 - 500;	Low limit value in mΩ
TIMER	ON; or OFF;	Selects whether test is used or OFF. Command is required to stop.
TIME	0.3 - 999.9;	Selects test time

2.5.3 GB test setting queries

QUERY	ANSWER FORMAT
CURR?	Value in Amps, e.g. 11.11
FREQ?	AC50 or AC60
HLIM?	Value in mΩ
LLIM?	Value in mΩ,
TIMER?	"ON" or "OFF"
TIME?	Value in seconds, e.g. 11.1
ALLSETS?	All answers separated by space in same order as above

2.5.4 GB test result queries

QUERY	INFO	ANSWER FORMAT
RESR?	Resistance	Value in mΩ, e.g. 11.1
RESVOLT?	Voltage	Value in Volts, e.g. 50
RESCUR?	Current	Value in A, e.g. 11.11
STAT?	Status	Status number, e.g. 11, please below for meaning
TIM?	Time	aa (0.1s resolution)
RES?		All answers separated by space in same order as above

STATUS	MEANING
0	No Errors Detected
1	Running
2	Init
3	Shutdown
4	Interrupted
5	Measured Resistance Under Low Limit
6	Measured Resistance Over High Limit
7	Safety Circuit Opened
8	Error - Over Range
9	Inverter shutdown failed
10	GB Measurement Shutdown Failed
11	Failed to reach test voltage. Check Connections

2.6 DMM Test Commands

COMMAND	INFO
U;	Target indicator
R;	Target indicator
I;	Target indicator
f;	Target indicator

2.6.1 DMM test control commands

COMMANDS FOR U

COMMAND	VALUE	INFO
ACDC	AC; / DC;	Selects AC or DC measurement
RANGE	1-6;	Sets measurement range 1; = 0.1V 2; = 1V 3; = 10V 4; = 100V 5; = DC 1000V or AC 750V 6; = AUTO
MODE	SING; or CONT;	Selects whether Quanti should take single measurement or keep measuring until shutdown
LIMS	ON; or OFF;	Selects if limist are used in test
HLIM	xxx yyy;	High limit xxx=value (-1000 to 1000) yyy=unit! ("mV" or "V", case sensitive)
LLIM	xxx yyy;	Low limit xxx=value (-1000 to 1000) yyy=unit! ("mV" or "V" , case sensitive)

COMMANDS FOR R

COMMAND	VALUE	INFO
RANGE	1-8;	Sets measurement range 1; = 100Ω 2; = 1kΩ 3; = 10kΩ 4; = 100kΩ 5; = 1MΩ 6; = 10MΩ 7; = 100MΩ 8; = AUTO
MODE	SING; or CONT;	Selects whether Quanti should take single measurement or keep measuring until shutdown
LIMS	ON; or OFF;	Selects if limist are used in test
HLIM	xxx yyy;	High limit xxx=value (-1000 to 1000) yyy=unit! "Ohm" "kOhm", Or "MOhm" (Ω Not in ascii, "Ohm" used instead, case sensitive).
LLIM	xxx yyy;	Low limit xxx=value (-1000 to 1000) yyy=unit! "Ohm" "kOhm", Or "MOhm" (Ω Not in ascii, "Ohm" used instead, case sensitive).

COMMANDS FOR I

COMMAND	VALUE	INFO
ACDC	AC; or DC;	Selects AC or DC measurement
RANGE	1-6;	Sets measurement range 1; = 0.01A 2; = 0.1A 3; = 1A 4; = 10A 5; = AUTO
MODE	SING; or CONT;	Selects whether Quanti should take single measurement or keep measuring until shutdown
LIMS	ON; or OFF;	Selects if limist are used in test
HLIM	xxx yyy;	High limit xxx=value (-1000 to 1000) yyy=unit! ("mA" or "A", case sensitive)
LLIM	xxx yyy;	Low limit xxx=value (-1000 to 1000) yyy=unit! ("mA" or "A", case sensitive)

COMMANDS FOR f

COMMAND	VALUE	INFO
RANGE	1-6;	Sets measurement range 1; = 0.1V 2; = 1V 3; = 10V 4; = 100V 5; = 750V 6; = AUTO
MODE	SING; or CONT;	Selects whether Quanti should take single measurement or keep measuring until shutdown
LIMS	ON; or OFF;	Selects if limist are used in test
HLIM	xxx yyy;	High limit xxx=value (-1000 to 1000) yyy=unit! "Hz" or "kHz", case sensitive.
LLIM	xxx yyy;	Low limit xxx=value (-1000 to 1000) yyy=unit! "Hz" or "kHz", case sensitive.

2.6.2 Queries for asking current values of settings

QUERIES FOR U

QUERY	INFO	ANSWER FORMAT
ACDC?	ac/dc	aa ("AC" or "DC")
RANGE?	range	aa (Number encoded, see above settings)
MODE?	mode	aa ("SING" or "CONT")
LIMS?	Limits Used	aa ("ON" or "OFF")
HLIM?	High Limit	xxx yyy (xxx=value yyy==unit)
LLIM?	Low Limit	xxx yyy (xxx=value yyy==unit)
ALLSETS?	all	All answers separated by space in same order as above

QUERIES FOR R

QUERY	INFO	ANSWER FORMAT
RANGE?	range	aa (Number encoded, see above settings)
MODE?	mode	aa ("SING" or "CONT")
LIMS?	Limits Used	aa ("ON" or "OFF")
HLIM?	High Limit	xxx yyy (xxx=value yyy==unit)
LLIM?	Low Limit	xxx yyy (xxx=value yyy==unit)
ALLSETS?	all	All answers separated by space in same order as above

QUERIES FOR I

QUERY	INFO	ANSWER FORMAT
ACDC?	ac/dc	aa ("AC" or "DC")
RANGE?	range	aa (Number encoded, see above settings)
MODE?	mode	aa ("SING" or "CONT")
LIMS?	Limits Used	aa ("ON" or "OFF")
HLIM?	High Limit	xxx yyy (xxx=value yyy==unit)
LLIM?	Low Limit	xxx yyy (xxx=value yyy==unit)
ALLSETS?	all	All answers separated by space in same order as above

QUERIES FOR f

QUERY	INFO	ANSWER FORMAT
RANGE?	range	aa (Number encoded, see above settings)
MODE?	mode	aa ("SING" or "CONT")
LIMS?	Limits Used	aa ("ON" or "OFF")
HLIM?	High Limit	xxx yyy (xxx=value yyy==unit)
LLIM?	Low Limit	xxx yyy (xxx=value yyy==unit)
ALLSETS?	all	All answers separated by space in same order as above

2.6.3 Test control queries

COMMON FOR ALL DMM TESTS

QUERY	INFO	ANSWER
RES?		xxx yyy (value, unit, status)
STAT?		aa

2.6.4 Status values encoding - ASCII values!

COMMON FOR ALL DMM TESTS

STATUS	MEANING
0	No Errors Detected
1	Initializing
2	Running
3	Interrupted
4	Under Low Limit
5	Over High Limit
6	Safety Circuit Opened
7	Error - Over Range
8	Error - Mode could not be set

3. EXAMPLES OF PC REMOTE COMMUNICATION

3.1 Setting HV to DC mode

COMMAND STRING (EXCLUDING) LF (=0X0A, NL LINE FEED, NEW LINE)

```
Q0;HV;ACDC DC;
```

COMMAND	MEANING
Q0;	Command meant for device with Quanti link address set to 0.
HV;	Command meant for HV test.
ACDC DC;	ACDC value set to DC.

ANSWER FROM QUANTI

```
OK
```

OK	Command was correct and Quanti HV test is now DC mode

3.2 Answer for sending wrong command

COMMAND STRING (EXCLUDING) LF (=0X0A, NL LINE FEED, NEW LINE)

```
Q0;HV;ACDC CC;
```

ANSWER FROM QUANTI

```
ERR 5
```

ERR 5	Quanti answers with error code. Correct meanings for error codes can be found in the **chapter 2.2, page 47.** Invalid value for ACDC setting.

3.3 Example of running test with PC remote

EXAMPLE TRAFFIC DURING HV TEST

```
Sent: Q0;HV;ON;
Received:  OK
Sent: Q0;HV;RES?;
Received:  0.001 0.001 55 1 0.2
Sent: Q0;HV;RES?;
Received:  0.001 0.001 50 1 0.8
Sent: Q0;HV;RES?;
Received:  0.001 0.001 49 0 1.0
```

BREAKDOWN

```
Sent: Q0;HV;ON;
Received:  OK
```

HV test started and command is OK.

```
Sent: Q0;HV;RES?;
Received:  0.001 0.001 55 1 0.2
Sent: Q0;HV;RES?;
Received:  0.001 0.001 50 1 0.8
```

Results are being polled while the test is running. Status number marked by red circle has a value of one, meaning that the test is running.

```
Sent: Q0;HV;RES?;
Received:  0.001 0.001 49 0 1.0
```

HV test results have been polled. Status number by red circle has a value of zero, meaning that the test is finished with no errors detected. The values given by this result poll are the final result values of the test.