TECHMIZE by TONGHUI

OM

OPERATION MANUAL

TH199X Series

Precision Source/Measure Units — TH1991C / TH1991B / TH1991A / TH1991 (single channel) and TH1992B / TH1992A / TH1992 (dual channel). Covers front-panel operation, measurement setup and system configuration for the whole platform family; see the separate TH199X Series SCPI Command Reference for the full remote-command set.

Techmize Electronic GmbH · Ismaning, Germany

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English edition

TH199X Series Operation Manual

Precision Source/Measure Units — TH1991C / TH1991B / TH1991A / TH1991 / TH1992B / TH1992A / TH1992

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CHAPTER 1

Safety & Compliance

1.1 About this manual

This manual covers the Techmize TH199X series of precision source/measure units (SMUs). The TH1991 series has one channel and the TH1992 series has two. All seven models share the same front-panel controls, display system and menu structure; they differ in channel count, source resolution, pulse output and voltage/current range, as summarised below. Where this manual and the instrument itself appear to disagree, or a described function is not present on your particular model, contact Techmize or your authorized distributor (§1.9) before relying on the instrument for measurement or safety decisions.

Techmize continually improves the performance, features and construction of its instruments; content, specifications and accessories described here are subject to change without notice.

Model	Channels	Max. DC voltage / current	Pulse current	Source resolution (V / I)	Measurement resolution (V / I)
TH1991C	1	±63 V / ±1.515 A	—	5.5-digit · 1 µV / 1 pA	6.5-digit · 100 nV / 100 fA
TH1991B	1	±210 V / ±3.03 A	—	5.5-digit · 1 µV / 100 fA	6.5-digit · 100 nV / 10 fA
TH1991A	1	±210 V / ±3.03 A	±10.5 A	5.5-digit · 1 µV / 1 pA	6.5-digit · 100 nV / 100 fA
TH1991	1	±210 V / ±3.03 A	±10.5 A	6.5-digit · 100 nV / 10 fA	6.5-digit · 100 nV / 10 fA
TH1992B	2	±210 V / ±3.03 A	—	5.5-digit · 1 µV / 100 fA	6.5-digit · 100 nV / 10 fA
TH1992A	2	±210 V / ±3.03 A	±10.5 A	5.5-digit · 1 µV / 1 pA	6.5-digit · 100 nV / 100 fA
TH1992	2	±210 V / ±3.03 A	±10.5 A	6.5-digit · 100 nV / 10 fA	6.5-digit · 100 nV / 10 fA

1.2 Safety symbols used in this manual

Symbol	Meaning
⚠ WARNING	a hazard that, if not avoided, could result in personal injury or death — this instrument can output up to ±210 V DC.
! CAUTION	a hazard that, if not avoided, could damage the instrument or the device under test (DUT), or invalidate a measurement.
ⓘ NOTE	supplementary information that helps with correct or efficient use, but is not itself a hazard.
⏚ Chassis ground	chassis ground terminal, marked next to each channel's source/measure terminals (§7.1).

1.3 General safety requirements

The TH199X series is a **Protection Class I** instrument: protective earthing through the three-wire power cord is essential to safety and must not be defeated. The source/measure terminals can carry up to ±210 V DC.

> **WARNING — ELECTRIC SHOCK**
>
> Always use a supply outlet with a protective earth contact. Never connect the AC supply, or operate the instrument, with the protective ground disconnected. Never touch the DUT, test leads or source/measure terminals while a channel output is enabled — a CH key lit **red** indicates that the channel is in the high-voltage state. Disconnect the power cord before replacing the fuse.

Supply: **90–264 V AC**, 47–63 Hz, ≤250 VA. Replace the fuse only with the type and rating marked on the rear-panel label.

> **WARNING — GUARD TERMINAL**
>
> Do not connect the Guard terminal to any output, including the common circuit, the chassis ground wire or any other protective terminal — this can damage the instrument. Use only the dedicated Techmize/Tonghui test box or triaxial cable for guarded measurements (§7.1).

Environment

	Operating	Storage
Temperature	0 °C to +55 °C (reference: 23 °C ± 5 °C)	−30 °C to +70 °C
Humidity	30 % to 80 % RH, non-condensing	10 % to 90 % RH, non-condensing
Altitude	0 to 2000 m (6561 ft)	0 to 4600 m (15092 ft)

- For indoor use only. Keep the instrument away from dust, vibration, direct sunlight and corrosive gases.
- The instrument is force-ventilated, with air intake at the sides and exhaust at the rear. Keep these openings clear; restricted ventilation raises the internal temperature and degrades accuracy.
- If the instrument is not used for a long time, store it in its original packaging in a ventilated room, free of corrosive impurities and out of direct sunlight.
- Use the instrument in a low-noise environment where possible; if the mains supply is noisy, fit a power-line filter ahead of the instrument.
- Do not switch the instrument on and off frequently — stored data may be lost.
- The maximum current of the chassis ground terminal is 3 A DC.

Test fixtures, cables and USB memory

Use only test fixtures, adapter boxes and test cables supplied or approved by Techmize/Tonghui (§2.1, §7.1). To remove a USB memory from the front-panel USB port, wait 10 seconds before inserting it again or inserting a different one. Never switch the instrument off while the USB memory is being accessed — the memory or the instrument may be damaged.

1.4 Warm-up

Allow at least **60 minutes** of warm-up after switch-on before relying on rated accuracy.

1.5 Low Voltage & EMC compliance

The TH199X series is designed and tested to meet the essential requirements of the following EU directives:

Directive	Harmonised standard(s)
Low Voltage Directive 2014/35/EU	EN 61010-1:2010+A1:2019
EMC Directive 2014/30/EU	EN 61326-1:2021; CISPR 11:2015+A1:2016+A2:2019 (Group 1, Class A); EN 61000-4-2:2009, EN 61000-4-3:2020, EN 61000-4-4:2012, EN 61000-4-5:2014+A1:2017, EN 61000-4-6:2014, EN 61000-4-11:2020; EN 61000-3-2:2019+A1:2021, EN 61000-3-3:2013+A1:2019+A2:2021

As a Class A / Group 1 instrument, the TH199X series is intended for industrial and laboratory environments; it may not provide adequate protection against radio interference in a residential setting.

Electrical safety (reference operating conditions)

Item	Value
Insulation resistance, power terminals to housing	≥ 50 MΩ (≥ 2 MΩ under hot and humid transport conditions)
Dielectric strength, power terminals to housing	1.5 kV, 50 Hz AC for 1 minute — no breakdown or flashover
Leakage current	≤ 3.5 mA

1.6 WEEE

Do not dispose of the instrument as unsorted municipal waste at the end of its service life. Within the EU, return it to Techmize, your distributor, or a designated collection point, in accordance with the WEEE Directive (2012/19/EU).

1.7 Warranty & liability

Techmize warrants this instrument to be free from defects in material and workmanship for a period of two (2) years from delivery to the original purchaser, excluding damage from misuse, unauthorised modification or repair, consumable/wear items (fuses, connectors, test cables and adapter fixtures), or operation outside the environmental limits in §1.3. Repair of the instrument must be carried out by qualified personnel; the instrument must be re-calibrated after repair so that test accuracy is not affected. Do not replace internal components without authorisation — damage caused by unauthorised repair is not covered. Except as stated here, Techmize makes no other warranty, express or implied.

1.8 Common platform data

Item	Value
Dimensions (W × H × D), complete instrument	235 × 154 × 530 mm
Dimensions (W × H × D), rack frame	215 × 132 × 490 mm
Weight	≈ 8.5 kg (single channel) / ≈ 10 kg (dual channel)
Display	7-inch capacitive touch screen, 800 × 480
User interface	English
Maximum output power	31.8 W
Standard interfaces	RS232C, USB HOST, USB DEVICE, LAN, HANDLER (GPIB optional)
Calibration cycle	1 year

1.9 Manufacturer & EU contact

Techmize Electronic GmbH

Office 125–126, Regus
Carl-Zeiss-Ring 15a, 85737 Ismaning,
Germany
An international subsidiary of Changzhou
Tonghui Electronic Co., Ltd. (China)

Contact

Mobile: +49 171 4981898
Email: dx.han@tonghui.com.cn
Web: en.tonghui.com.cn

Registration

Managing Director: Haohua Zhao
Register Court: Amtsgericht München
HRB 312530 · VAT ID DE463170824

CHAPTER 2

Out of the Box

2.1 Unpacking

Check the shipping carton and its contents against the list below before use. If the carton or contents show signs of transport damage, do not power on the instrument — contact your carrier and your Techmize distributor before proceeding.

Item	Description	Qty TH1991 series	Qty TH1992 series
Instrument	TH1991 series (1 channel) or TH1992 series (2 channels)	1	1
Power cable	EU power cable (Schuko, CEE 7/7)	1	1
TH26050B	Dual-end test cable (2-wire)	1	2
TH26050C	Four-end test cable (5-wire, Kelvin)	1	2
TH26087B	Banana plug to dual BNC adapter (2-wire)	1	2
TH26017	USB cable	1	1
TH199X-001	Control & DAQ software	1	1
Fuse	Spare fuse	2	2
Documents	Operation manual · test report · quality assurance certificate	1 each	1 each

TH1992-series instruments ship with two sets of test cables and adapters — one per channel. If anything is missing or incorrect, contact your Techmize distributor. Keep the original packaging — it is the recommended way to store or return the instrument.

Optional accessories (low-noise filters, adapter boxes, shield box, triaxial cables and the GPIB adapter) are listed in §7.1.

2.2 Connecting the power supply

Supply: 90–264 V AC, 47–63 Hz, ≤250 VA. Use the supplied EU power cable (Schuko, CEE 7/7) and a mains outlet with a protective earth contact; confirm that the fuse fitted matches the rating marked on the rear-panel label before connecting.

2.3 Connecting test leads and fixtures

Connect the appropriate test cable or adapter box to the channel's source/measure terminals (§3.1, §7.1). Use only fixtures and cables supplied or approved by Techmize/Tonghui for this instrument — see §1.3 for why this matters for both accuracy and safety. Before changing the connection method, make sure the channel output is off and the CH key lamp is off.

2.4 Starting the instrument for the first time

1. Connect the power cable at the rear panel.
2. Press the **POWER** switch at the lower right of the front panel.
3. The instrument opens on the **Home** page (§3.3).

Allow at least 60 minutes of warm-up before relying on the rated accuracy (§1.4). For an overview of the front panel, rear panel and basic navigation, continue to Chapter 3.

CHAPTER 3

Getting to Know the Instrument

3.1 Front panel



Figure 3-1 Front panel (TH1991 shown; the TH1992 series has the same layout)

1 **Model label** — instrument brand, model name and channel count.

2 **Touch display** — 7-inch capacitive touch screen (800 × 480); shows readings, source settings and instrument status.

3 **Page menu** — soft keys at the right edge of the display: **Home**, **Config**, **Quick IV**, **Expert**, **File**, **System**. Inside a channel's settings the menu shows the options for the selected field.

4 **Knob** — in a parameter-setting box, turn to change the value and press to confirm and close. On the Graph and Roll pages, turn to move the marker or adjust the axis interval.

5 **Channel 1 terminals** — Sense HI/LO, Force HI/LO, Guard and chassis ground (§7.1).

6 **USB-A port** — for a USB memory (save/recall files and screenshots).

7 **CH1** — enables or disables channel 1. A channel that is in the output state is disabled by this key even if the instrument is in the remote state. The key lights yellow when the channel is enabled and red when it is in the high-voltage state.

8 **CH2** — same function for channel 2 (dual-channel models).

9 **Trigger** — starts a single measurement; stops repeated measurements if they are running.

10 **Auto** — starts repeated measurements; stops them if they are running.

11 **Local** — returns the instrument from the remote state to local control.

12 **POWER** — instrument on/off switch.

3.2 Rear panel



Figure 3-2 Rear panel (TH1992 series shown)

1 **Cooling fan** — forced ventilation (air intake at the sides, exhaust at the rear).

2 **Serial-number label** and rating information.

3 **Power inlet** — three-wire IEC inlet, 90–264 V AC.

4 **Fuse holder.**

9 **Channel 2 terminals** — dual-channel models only: Sense HI/LO, Force HI/LO, Guard and chassis ground (§7.1).

5 **HANDLER** — DB25 female connector for general-purpose I/O: trigger input/output, digital signals and handler control (Chapter 10).

6 **USB (device)** — USB-B port for connecting to a PC (USBTMC or USBCDC, §9.2).

7 **LAN** — 10/100 Base-T. The left LED shows activity; the right LED shows link integrity.

8 **RS232** — DB9 serial interface for remote control (§9.2).

> **NOTE — GPIB**
> The instrument itself is not fitted with a GPIB interface. If required, an optional GPIB adapter (TH26075F) is available as a separate accessory.

3.3 Power-on and the Home page

After you press **POWER**, the instrument opens on the **Home** page, its main screen. The Home page shows the dual view: the upper area is channel 1 and the lower area is channel 2. Each area displays the measurement results, the source settings and the measurement settings for that channel (Chapter 4). Double-click a channel area to open that channel's settings.

3.4 Page map

Page	Purpose	Chapter
Home	Channel displays: source function, ranges, output value and limit. Double-click a channel to open its settings (output function, waveform, trigger).	4
Config	Processing of measurement results: filter, relative offset, math functions and limit test (pass/fail, grading and sorting).	5
Quick IV	Graph view (X–Y plot of measurement or math results) and Roll view (time-domain plot) for channel 1 and channel 2.	6

Page	Purpose	Chapter
Expert	Graphical analysis of semiconductor parameters — built-in test functions for resistors, diodes, FETs, BJTs, IGBTs and universal tests.	6
File	List of stored files; save, copy, paste, rename and delete.	6
System	Communication, user, date/time, network, digital I/O, upgrade and tool settings.	6

3.5 Basic operation

- Touch the page name in the menu at the right of the screen to open a page.
- Touch a parameter's white box. When the box edge turns yellow, either choose an option from the menu bar at the right of the screen, or a number-setting page opens.
- To enter a number, use the on-screen number keys and confirm with Enter — or use ← and → to select the digit, adjust it with the knob, and press the knob to confirm.
- Swipe up, down, left or right on the touch screen to move to the area you want (for example between the three channel-settings pages, or across a graph).
- Parameters that switch between two states (for example On/Off) toggle each time you touch them.

CHAPTER 4

Home Page & Channel Settings

This chapter documents every field on the Home page and on the channel-settings pages reached by double-clicking a channel. The field set is identical across all seven models unless noted; range and resolution differences between models are listed in the TH199X Series Technical Guide.

4.1 Home page

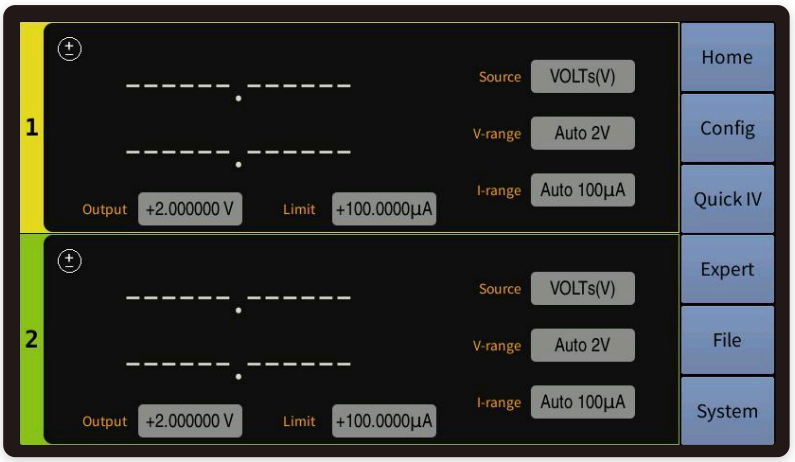

Figure 4-1 Home page (dual view)

Field	Options / range	Meaning
Source	VOLTs (V) · AMPs (I)	Source function: voltage source or current source.
V-range	Auto · Fixed	Voltage range. With a voltage source it is the output voltage range; with a current source it is the voltage measurement range.
I-range	Auto · Fixed	Current range. With a current source it is the output current range; with a voltage source it is the current measurement range.
Output	numeric	Source output value. Set with the number keys and Enter, or with ← / →, the knob and a press of the knob.
Limit	numeric	Limit (compliance) value that protects the DUT against overcurrent or overvoltage: the current limit applies to a voltage-source channel and the voltage limit to a current-source channel. When the limit is reached the channel operates as a constant-current or constant-voltage source and holds the limit value.

> **NOTE**
> If the current limit is set very low, the SMU takes longer to settle. A current-source channel can also reach voltage compliance if the DUT or the other channel prevents the set current from flowing. Minimum limit values are given in §8.1.

4.2 Channel settings — Page 1 (output function)

Double-click a channel area on the Home page. The lower half of the screen shows three pages of settings for that channel; swipe left or right to change page, and double-click the channel area again to return to the dual view.

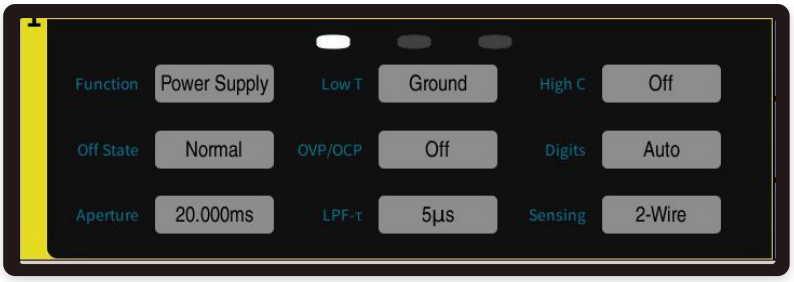

Figure 4-2 Channel settings, page 1

Field	Options / range	Meaning
Function	Power Supply · Voltmeter · Ammeter · Ohmmeter	Channel function (Chapter 7 describes each).
Low T	Ground · Float	Connection state of the low-side terminal.
High C	On · Off	High-capacitance mode. Allows stable measurement of capacitive loads above 0.01 µF, up to 50 µF. If readings are unstable on a capacitive load, set High C to On. See the note below.
Off State	Normal · High Z · Zero	Output condition applied automatically when the channel output is turned off; must be set before enabling the output (Table 4-1).
OVP/OCP	On · Off	Over-voltage / over-current protection. When On, the output is shut down immediately if the SMU reaches compliance.
Digits	Auto · 3.5 · 4.5 · 5.5 · 6.5	Displayed resolution. Except for Auto, the readings show 4, 5, 6 and 7 digits respectively.
Aperture	numeric (time)	Measurement time — the time needed to obtain one reading. A longer aperture gives more accurate, more stable readings and a slower test.
LPF-τ	5 µs – 500 µs	Time constant of the source output filter, which keeps the output free of spikes and overshoot. All filters can increase SMU settling time.
Sensing	2-wire · 4-wire	Terminal connection type (§7.1).

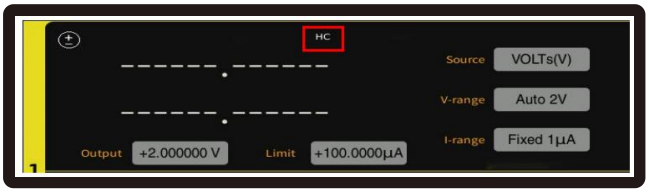

Figure 4-3 High C switched on

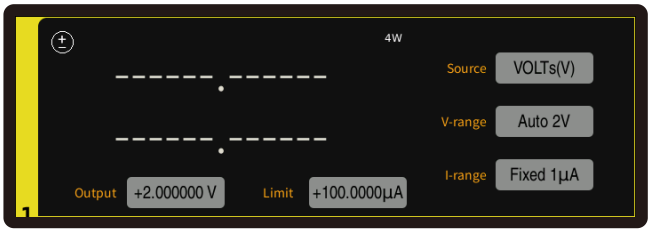

Figure 4-4 Sensing set to 4-wire

> **NOTE — HIGH-CAPACITANCE MODE**
>
> High-capacitance mode operates in voltage-source mode only, with fixed current measurement ranges (the 10 nA and 100 nA ranges are not available) and a current limit of 1 µA or more.

Table 4-1 Output-off states

Off State	Condition after the output is turned off
High Z	Output relay open. Voltage-source and current-source settings remain unchanged. Not applicable if the current range is set to 1 A or higher.
Normal	Voltage source, 0 V output. Current compliance 100 µA: if the previous range was 100 µA or lower, the 100 µA range is used; if it was 1 mA or higher, the range remains unchanged. Output relay open.
Zero	Voltage source, 0 V output, range unchanged. Current compliance 100 µA on the 100 µA range.

4.3 Channel settings — Page 2 (output waveform)

The **AWG** field selects the source output waveform: **DC** (constant voltage/current), **Pulse**, **Sweep** or **List**. The default is DC. The lower half of the page then shows the parameters for the selected waveform.

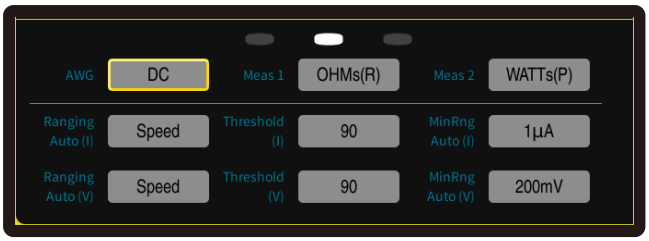

Figure 4-5 AWG = DC

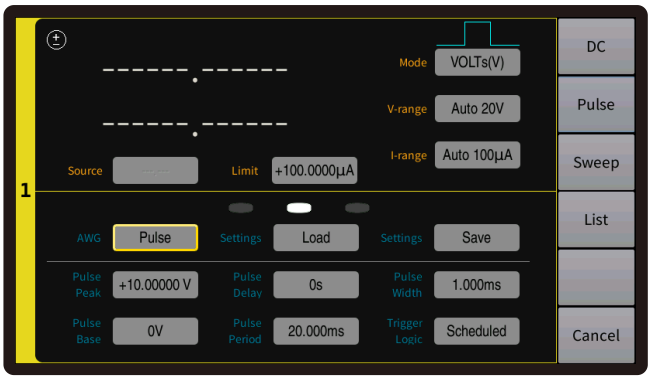

Figure 4-6 AWG = Pulse

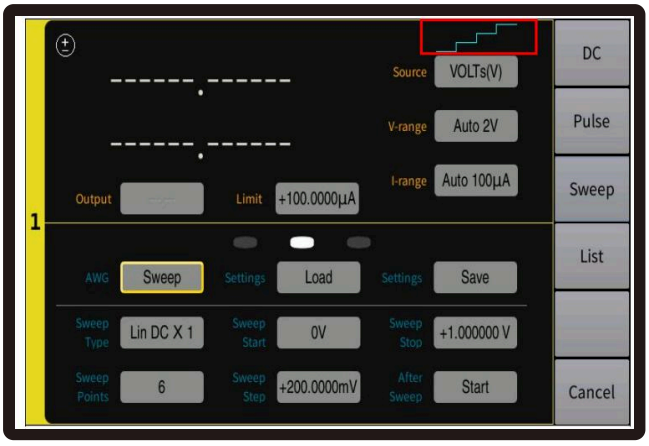

Figure 4-7 AWG = Sweep

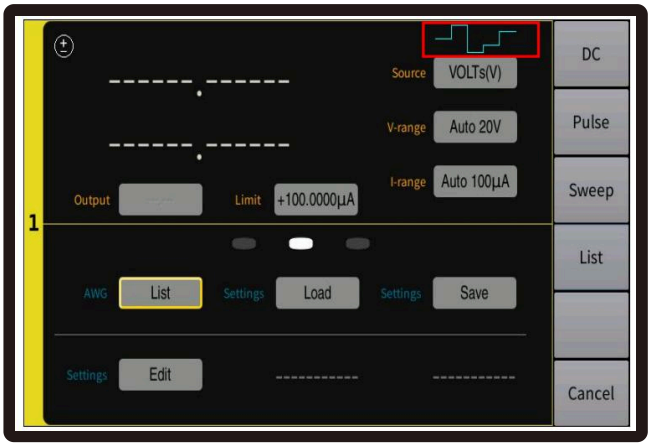

Figure 4-8 AWG = List

4.3.1 DC

Field	Options / range	Meaning
Ranging Auto (I) / Ranging Auto (V)	Normal · Speed · Resoln	Auto-range operating mode (Table 4-2). With a voltage source, the current auto range applies to the measured current and the voltage auto range to the output voltage; with a current source it is the reverse.
Threshold	numeric (ratio)	Shift threshold used by the auto-range operation. When the measured data reaches the threshold condition, the range changes automatically.
Meas 1 / Meas 2	VOLTs (V) · AMPs (I) · OHMs (R) · WATTs (P)	Measurement parameters shown on the page.

Table 4-2 Auto-range modes

Mode	Range operation
Normal	Basic operation and upward range changes.
Speed	Basic operation, upward and downward range changes.
Resoln	Basic operation and downward range changes.

- **Basic operation:** the channel selects the range that gives the best resolution for the measurement.
- **Upward:** if the measured data ≥ value1, the range is changed up after the measurement (value1 = measurement range × ratio / 100).
- **Downward:** if the measured data ≤ value2, the range is changed down after the measurement (value2 = measurement range × ratio / 1000).

4.3.2 Pulse

Field	Options / range	Meaning
Settings (left) / Settings (right)	Load · Save	Recall or save a set of pulse-source settings (peak, delay, width, bias).
Pulse Peak	numeric	Peak (high) level of the pulse.
Pulse Delay	numeric (time)	Delay after the trigger delay, after which the pulse source changes from the base value to the peak value.
Pulse Width	numeric (time)	Pulse width, measured from the 10 % leading edge to the 90 % trailing edge. Minimum programmable pulse width 50 µs, resolution 1 µs; limits per voltage/current combination in §8.2.
Pulse Bias	numeric	Base (low) level of the pulse.

4.3.3 Sweep

Field	Options / range	Meaning
Settings (left) / Settings (right)	Load · Save	Recall or save a set of sweep-source settings (type, start, stop, points, step, after-sweep).
Sweep Type	Lin DC×1 · Lin Pul×1 · Lin DC×2 · Lin Pul×2 · Log DC×1 · Log Pul×1 · Log DC×2 · Log Pul×2	Sweep shape (Table 4-3).
Sweep Start / Sweep Stop	numeric	Start point and end point of the sweep.
Sweep Points / Sweep Step	1 – 2500 points	Number of sweep points and value of each step. Set one of the two; the other follows. Step value does not apply to Log sweeps.
After Sweep	Start · End	Where the output rests when the sweep has finished.

Table 4-3 Sweep types

Sweep type	Description
Single Lin DC (Lin DC×1)	DC source in linear steps from the start point to the end point.
Single Lin Pulse (Lin Pul×1)	Pulse source in linear steps from the start point to the end point.
Double Lin DC (Lin DC×2)	DC source in linear steps from the start point to the end point and back again.
Double Lin Pulse (Lin Pul×2)	Pulse source in linear steps from the start point to the end point and back again.
Single Log DC (Log DC×1)	DC source in logarithmic steps from the start point to the end point.
Single Log Pulse (Log Pul×1)	Pulse source in logarithmic steps from the start point to the end point.
Double Log DC (Log DC×2)	DC source in logarithmic steps from the start point to the end point and back again.
Double Log Pulse (Log Pul×2)	Pulse source in logarithmic steps from the start point to the end point and back again.

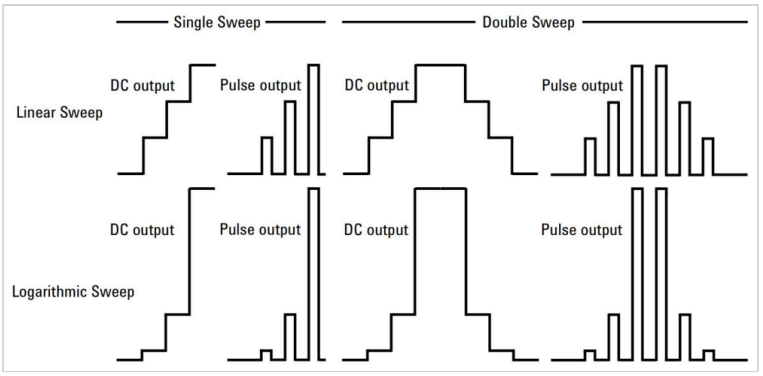

Figure 4-9 Sweep source output types

4.3.4 List

Field	Options / range	Meaning
Settings (top left) / Settings (top right)	Load · Save	Recall or save a set of list settings.
Settings (Edit)	—	Opens the list editor, where points can be added and deleted and each point value entered with the number keys or with ← / →, the knob and a press of the knob. A list holds up to 2500 points.

Saved sweep and list settings are stored as files that can be recalled from the **Load** button (§6.3).

4.4 Channel settings — Page 3 (trigger)

Trigger Layer selects the trigger layer: **ARM** or **FPGA**. When the trigger system starts, the ARM layer waits for the specified source and measurement signals; once the ARM condition is met, control passes to the FPGA layer, which waits for the specified internal timer signal and then starts the device operation.



Figure 4-10 Trigger layer: ARM



Figure 4-11 Trigger layer: FPGA

Field	Options / range	Meaning
Src Trig Signal / Meas Trig Signal	Auto · Bus · Manual · EXT0 – EXT13	ARM layer trigger source for the source and measurement signals. **Auto**: selected by the instrument for the current operating mode. **Bus**: the trigger sent over the remote-control interface. **Manual**: the front-panel **Trigger** key. **EXT0 – EXT13**: the external signal on the corresponding rear-panel HANDLER pin.
Src Trig Count / Meas Trig Count	Infinity · Number	FPGA layer trigger counts for source and measurement. When Number is selected, enter the count.
Src Trig Delay / Meas Trig Delay	numeric (time)	Delay between the trigger and the start of the source or measurement operation.
Src Trig Period / Meas Trig Period	numeric (time)	Source trigger period is the time each source step is held; measurement trigger period is the interval between measurements.

NOTE — SWEEP AND LIST TIMING

Source output time = source trigger count × source trigger period; measurement time = measurement trigger count × measurement trigger period. Measurement time must not be shorter than the source output time. If unsure how to set these, use the same count and the same period for source and measurement.

4.5 Channel settings — Page 4 (limit test)

This page appears only when the limit test is switched on in the Config page (Chapter 5). It shows the measurement data and the pass/fail (bin) result of the test.



Figure 4-12 Limit-test status page

CHAPTER 5

Config Page

The **Config** page processes the measurement results of a channel: filtering, deduction of a deviation (relative offset), mathematical operations and limit tests (pass/fail judgement, grading and sorting, with up to 14 bins). The stages are applied in a fixed order — **Filter → Relative offset → Math → Limit test** — and each stage takes the output of the previous stage as its input (**Feed Data**). Select the channel to process with the **CH1** / **CH2** selector.

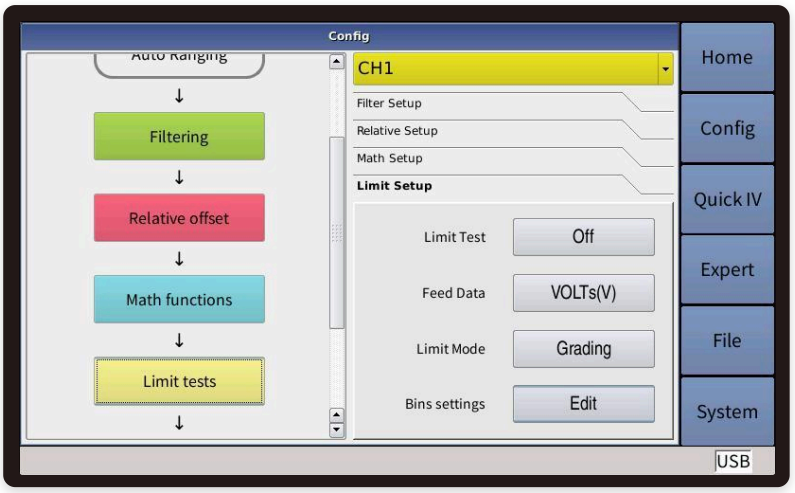

Figure 5-1 Config page — data-processing steps

5.1 Filter Setup

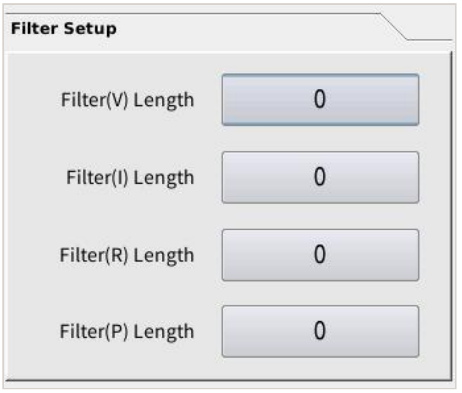

Figure 5-2 Filter Setup

Filters the voltage, current, resistance and power results separately. The filtering effect depends on the filter length; a length of 0 switches the filter for that function off.

Field	Range	Meaning
Filter (V) Length	0 – 10	Averaging length for voltage results (0 = off).
Filter (I) Length	0 – 10	Averaging length for current results (0 = off).
Filter (R) Length	0 – 10	Averaging length for resistance results (0 = off).
Filter (P) Length	0 – 10	Averaging length for power results (0 = off).

5.2 Relative Setup

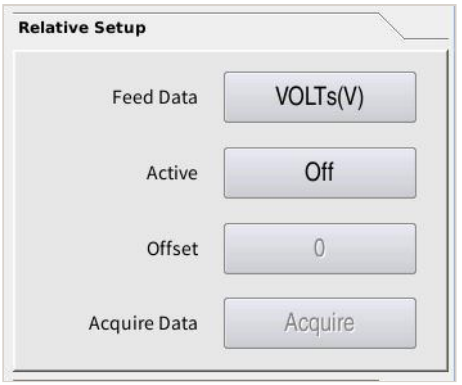

Figure 5-3 Relative Setup

Deducts a deviation from the output of the previous processing step, for voltage, current, resistance and power results separately, to obtain more accurate data: `y = x − offset`, where `x` is the output of the previous step and `y` the result.

Field	Options	Meaning
Feed Data	VOLTs · AMPs · OHMs · WATTs	The data type to which the offset applies.
Active	On · Off	Switches the deviation deduction on or off for the selected data type.
Offset	numeric	The deviation value; enter it manually or acquire it (below).
Acquire Data	Acquire	Takes a live reading and uses it as the offset.

5.3 Math Setup

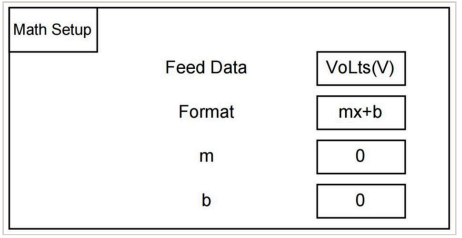

Figure 5-4 Math Setup (mx+b)

Applies a mathematical operation to the output of the previous processing step, for voltage, current, resistance and power results separately.

Field	Options	Meaning
Feed Data	VOLTs · AMPs · OHMs · WATTs	The data type to which the operation applies.
Format	Off · mx+b · Percent · Recip	**mx+b**: `y = mx + b` (enter `m` and `b`). **Percent**: `y = (x − ref) / ref` (enter `ref`). **Recip**: `y = 1 / x`.

5.4 Limit Setup

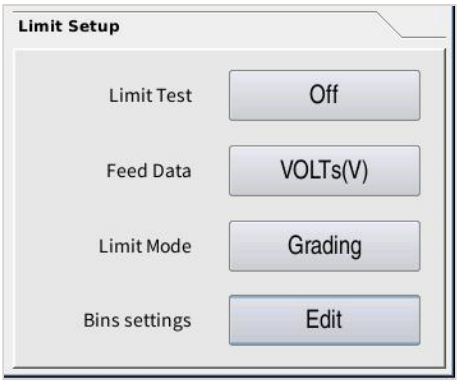

Figure 5-5 Limit Setup

The limit test judges the measurement data (or the math result) of the selected data type as pass or fail. The outcome can be output as a pin pattern on the HANDLER connector for handling equipment (Chapter 10).

Field	Options	Meaning
Limit Test	On · Off	Switches the limit test on or off. When On, the channel-settings page 4 shows the result (§4.5).
Feed Data	VOLTs · AMPs · OHMs · WATTs	The data type to be tested — the output of the previous processing step.
Limit Mode	Grading · Sorting	Judgement method (see below).
Bins settings	Edit	Opens the bin setup page for the selected mode.

Bin parameters (Grading and Sorting)

Parameter	Options	Meaning
Bin	drop-down list	Selects the bin to be set.
Limit Test	checkbox	Whether the limit test is performed for the selected bin.
Fail On	In · Out	**In**: values inside the limit range fail. **Out**: values outside the limit range fail.
Upper Limit / Low Limit	numeric	Upper and lower limit of the selected bin.
Pass Pattern / Fail Pattern	numeric (pin pattern)	**Grading:** the output-pin pattern set when the value passes / fails the selected bin. **Sorting:** Pass Pattern only — the output-pin pattern set when the value falls in the selected bin.

Public parameters

Parameter	Options	Meaning
Pass Pattern (Grading)	numeric	Output-pin state when the value passes all bins.
Fail Pattern (Sorting)	numeric	Output-pin state when the value fails all bins.
Auto Clear	checkbox	Whether all pin states are cleared automatically (default: cleared).
Clear On	Timer · Next Trigger · Power Off	The event that clears the pin states.
Clear Pattern	numeric	Pin state after clearing.
Timing	numeric (time)	Delay before the pins are cleared — for example, 500 ms clears the pins 500 ms after the bin decision.

CHAPTER 6

Quick I/V, Expert, File & System Pages

6.1 Quick IV page

The **Quick IV** page plots measurement results. It is used with the Sweep waveform: the measured points are recorded and joined into a curve. Touch **CH1** or **CH2** in the top menu bar and select **Graph** or **Roll** to plot the results of that channel. On either view the plot area can be moved and zoomed by fingertip.

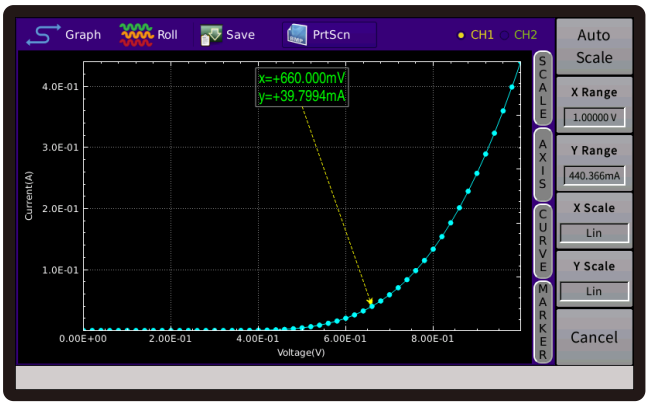

Figure 6-1 Graph view

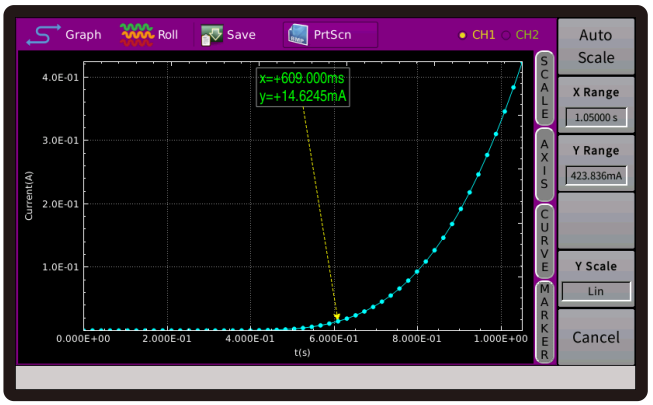

Figure 6-2 Roll view

- **Graph** — X–Y plot of the measurement or math results of channel 1 and/or channel 2.
- **Roll** — time-domain plot of the measurement data of channel 1 and/or channel 2.

The side menu at the right of the plot has four modules: **SCALE**, **AXIS**, **CURVE** and **MARKER**.

Module	Item	Function
SCALE	Auto Scale	Fits the trace automatically to the plot area.
	X Range / Y Range	Sets the displayed range of each axis. Adjust the digit with ← / →, turn the knob to change the value and press the knob to confirm.
	X Scale / Y Scale	Lin (linear) or Log (logarithmic) axis. On the Roll view only the Y scale can be set.
AXIS	X Axis / Y Axis	Quantity shown on each axis: I, V, R or P (Graph view). On the Roll view the Y axis shows I–t, V–t, R–t or P–t.
	X Grid / Y Grid	On or Off — shows or hides the grid lines.
CURVE	Scatter	On: draws the points as a scatter plot; Off: draws a continuous curve.
	Data→Memory	Keeps the current trace on the plot (as a dotted line) for comparison with the next measurement.
	Clear Memory	Deletes the retained trace.
	Total Points	Limits the number of points displayed to the most recent N points of the curve (all points are shown when N exceeds the number of points swept).
MARKER	Marker	On: shows a marker that reads out the data of one point of the curve. Move it with the knob.
	Step	Number of points the marker jumps per knob click (for example with Step = 5 the marker jumps to the sixth point after the current one).

Touch **Save** in the top menu to save the measurement data; touch **Screenshot** to save the current graph.

6.2 Expert page

The **Expert** page provides graphical analysis of semiconductor parameters with built-in test functions for resistors, diodes, FETs, BJTs, IGBTs and universal tests. Sweeps are configured and run directly on the instrument, without a PC.

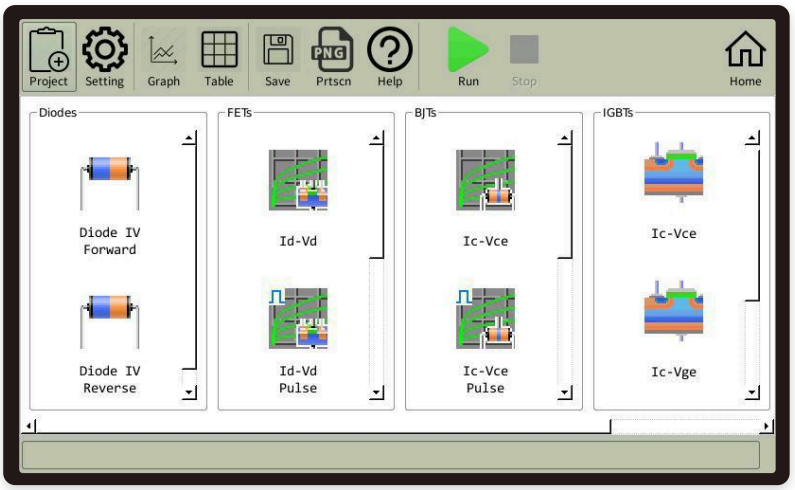

Figure 6-3 Expert page

Toolbar icon	Function
Setting	Opens the settings page of the selected test function.
Graph	Shows the measurement results as a graph.
Table	Shows the measurement results as a data table.
Save	Saves the test data and settings.
Prtscn	Saves the measurement graph as a screenshot.
Help	Opens the detailed description of the selected test function.
Run / Stop	Starts or stops the test.
Home	Returns to the Home page.

Running an Expert test

1. Connect the DUT to the channel terminals (§7.1), with the correct orientation and pin assignment for the device.
2. Touch **Expert** in the page menu and select the test function (for example **Diode IV Forward**); confirm the prompt to start the test configuration.
3. In the setting page, choose the channel(s) and set the sweep parameters — for a diode forward test, for example, start voltage, stop voltage, voltage step and current limit. Test functions marked *Pulse* also ask for pulse period and pulse width.
4. Touch **Run**. When the test has finished, the result is shown as a linear and a logarithmic curve (Graph) or as a data table (Table).
5. Use **Save** and **Prtscn** to store the data and the curve.

> **NOTE**
> Device characteristics depend on temperature, and datasheet curves are often scaled or drawn for specific conditions; compare a measured curve with a datasheet curve as a reference only.

6.3 File page

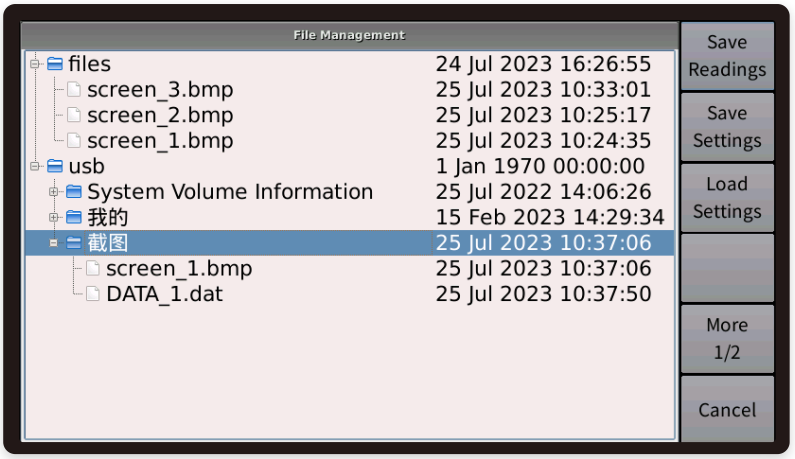

Figure 6-4 File page

The File page lists the stored files with name, type and creation time. Touch a file and use the menu at the right to save readings, save or recall settings, copy, paste, delete and rename files. Files can be kept in instrument memory or on a USB memory in the front-panel USB port.

Extension	Content
.swp	Sweep-source settings
.pls	Pulse-source settings
.dat	Measurement data
.bmp	Screenshot (Expert page)
.csv	Data table (Expert page)

- **Saving waveform settings:** in the channel-settings page 2, set AWG to Pulse, Sweep or List and edit the output; touch **Save** and choose a file (for example Sweep01 – Sweep05 or List01 – List05). Touch **Load** to recall a saved file.
- **Saving test data:** on the Quick IV and Expert pages, touch **Save** in the top menu.
- **Screenshots:** on the Quick IV and Expert pages, touch **Prtscn** / **Screenshot** to capture the current curve.

6.4 System page

The **System** page has four pages of settings; touch a group heading to open it.

> **CAUTION — FIRMWARE UPGRADE**
>
> Before upgrading, note the instrument's main (host) version, shown on the power-on screen and under **Update**. Each host version has its own upgrade package; a wrong package can leave the instrument unable to output and requires return to the factory.



Figure 6-5 System page 1

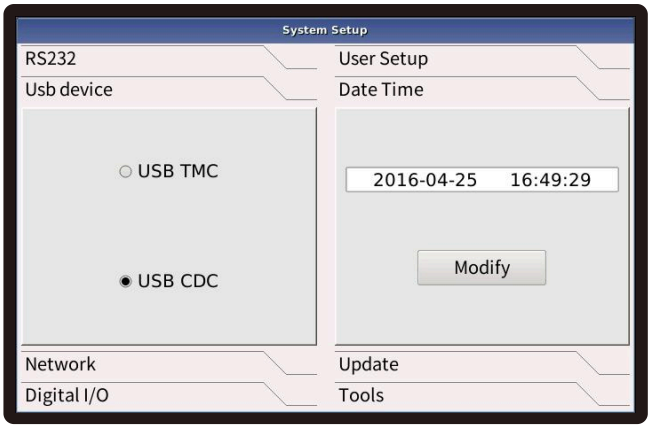

Figure 6-6 System page 2

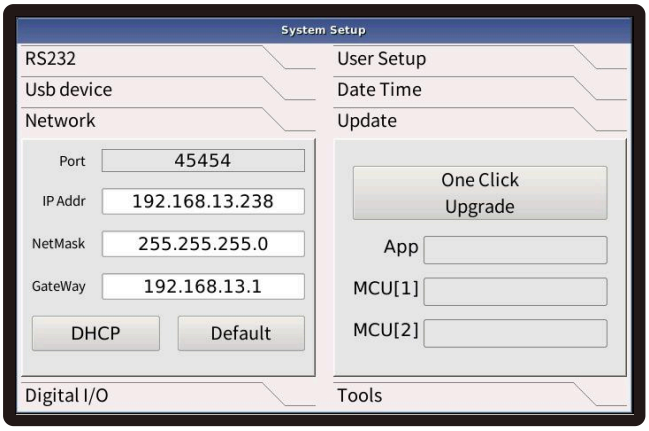

Figure 6-7 System page 3

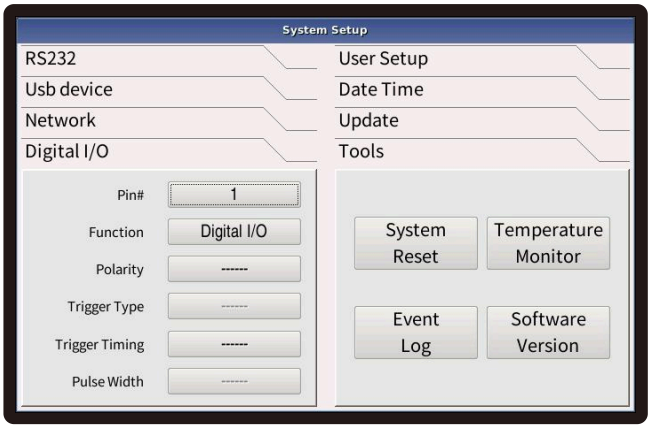

Figure 6-8 System page 4

Group	Field	Options	Meaning
RS232/GPIB	Baud Rate	4800 · 9600 · 19200 · 38400 · 115200	RS232 transmission rate (Chapter 9).
	GPIB Active	On · Off	Enables GPIB operation (requires the optional TH26075F GPIB adapter).
	GPIB Address	numeric	GPIB address of the instrument.
User Setup	Back Light	numeric (%)	Display backlight intensity.
	Power On	Factory · Last Saved	Settings applied at power-on.
	Beeper	On · Off	Switches the buzzer on or off.
USB Device	USB TMC / USB CDC	USB TMC · USB CDC	Protocol of the rear-panel USB device port: the USB Test & Measurement Class (USBTMC) or the USB Communication Device Class (USBCDC, a virtual serial port). Select USB CDC when controlling the instrument from a serial terminal (§9.2).
Date Time	Modify	—	Sets the instrument date and time.
Network	Port · IP Addr · NetMask · GateWay	numeric	Network port number, IP address, subnet mask and gateway address.
	DHCP	On · Off	Enables the Dynamic Host Configuration Protocol.
	Default	—	Restores the default network configuration.
Update	One Click Upgrade	—	Starts the firmware upgrade (see the caution below).
Digital I/O	Pin	selection	HANDLER pin to be configured.

Group	Field	Options	Meaning
	Function	Digital I/O · Trigger Out · Trigger In · HV Lamp	Function of the selected pin.
	Polarity	selection	Signal polarity of the selected pin.
	Trigger Type · Trigger Timing	selection	Trigger type and timing mode of the selected pin.
	Pulse Width	numeric (time)	Width of the trigger pulse.
Tools	System Reset	—	Restarts the system.
	Temperature Monitor	—	Shows the instrument temperature monitor.
	Event Log	—	Shows the event log.
	Software Version	—	Shows the instrument software version.

CHAPTER 7

Connections & Measurement Basics

7.1 Measurement terminals

Each channel has four pairs of terminals plus a guard and a chassis ground terminal: the current-driving terminals Force HI and Force LO, the voltage-sensing terminals Sense HI and Sense LO, the Guard, and chassis ground. Channel 1 is on the front panel; channel 2 (TH1992 series) is on the rear panel.

Terminal	Function
Force HI / LO	Drive the source output and carry the current. Up to ±210 V between HI and LO (as marked on the panel).
Sense HI / LO	Sense the voltage at the DUT for 4-wire (remote-sense) operation.
Guard	Connected to the inner shield of a triaxial cable, so that the shield and the inner conductor are at the same potential — no voltage difference, hence lower leakage and interference.
Chassis ground	Chassis ground terminal (green). Up to ±250 V DC may float between the LO terminal and chassis ground (as marked on the panel).

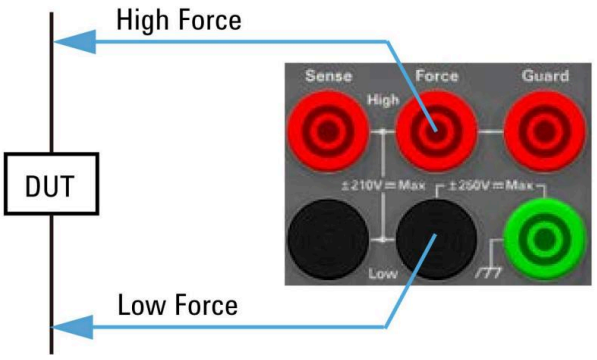

Figure 7-1 Two-wire connection

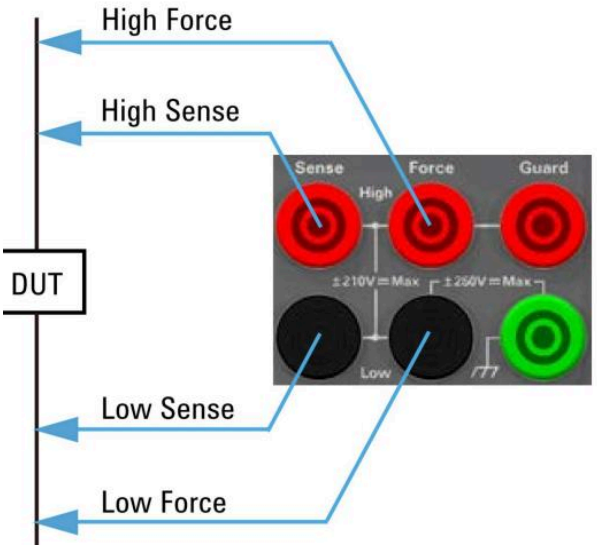

Figure 7-2 Four-wire connection

- **Two-wire connection:** connect only the Force terminals and leave the Sense terminals open. Force can be used to apply and measure DC voltage or current.
- **Four-wire connection:** use both Force and Sense terminals, connected to the DUT terminals. This minimises errors caused by the residual resistance of the test leads and is effective for low-resistance measurements and high-current measurements. Set **Sensing** to 4-wire (§4.2).

Guard

The guard reduces leakage current between the instrument and the DUT. A buffer amplifier keeps the guard conductor at the same potential as the force conductor, so no current flows between them and the instrument measures the same current as at the DUT terminal.

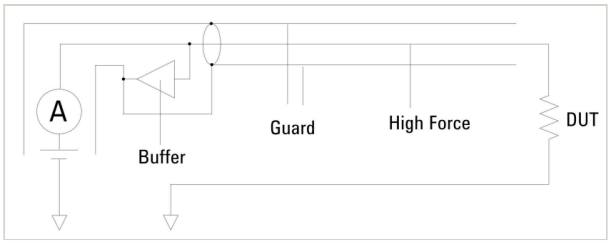

Figure 7-3 Guard circuit principle

WARNING

Do not connect the Guard terminal to any output, including the common circuit, the chassis ground wire or any other protective terminal — this can damage the instrument.

Test leads, fixtures and optional accessories

Item	Description	Supply
TH26050B	Dual-end test cable (2-wire)	Standard
TH26050C	Four-end test cable (5-wire, Kelvin)	Standard
TH26087B	Banana plug to dual BNC adapter (2-wire)	Standard
TH26087C	Banana plug to 4-terminal coaxial adapter	Optional
TH26087D	Banana plug to RF (4-terminal) test box	Optional
TH26087E	Shield box	Optional
TH26087F / G	Triaxial cable	Optional
TH1931-001	Low-noise filter (210 V / 3 A)	Optional
TH1931-002	Ultra-low-noise filter (21 V / 500 mA)	Optional
TH1931-003	Ultra-low-noise filter (42 V / 105 mA)	Optional
TH26075F	GPIB adapter	Optional

CAUTION

- Warm the instrument up for 60 minutes or more.
- Use the appropriate test fixture or test cable for the measurement.
- Do not apply an external voltage or current to the test terminals — this can damage the instrument.
- Before changing the connection method, confirm that the channel output is off and that the CH key lamps are off; otherwise the DUT can be damaged.

7.2 Measurement functions

Every setting below is made in the channel-settings pages (Chapter 4): double-click the channel area on the Home page, then swipe between the pages. After setting up, press the **CH1** / **CH2** key of the channel to enable its output, then press **Trigger** for one measurement each time, or **Auto** for continuous measurement.

Source voltage, measure current — and source current, measure voltage

1. On page 1, set **Function** to Power Supply.
2. On the Home page, set **Source** to VOLTs (V) to apply voltage and measure current, or to AMPs (I) to apply current and measure voltage.
3. Set **Output** (the source value) and **Limit** (the current limit for a voltage source, the voltage limit for a current source).
4. Set **V-range** and **I-range**. For a first (scouting) measurement, choose a generous range and set the limit according to the DUT's absolute maximum rating and the test requirement — never above what the DUT or the test can safely withstand. Once you have an approximate reading, refine the range and limit from the result.
5. Enable the output and start the measurement.

Voltmeter and ammeter

Set **Function** to Voltmeter or Ammeter and **Sensing** to 2-wire, then set the voltage or current range. Connect the source under test to the Force HI / LO terminals (two-wire connection uses only the Force terminals) and start the measurement. As a voltmeter, the channel behaves as a current source set to 0 A, so its input resistance is very high; as an ammeter, it behaves as a voltage source set to 0 V, so its internal resistance is very low.

Ohmmeter

Set **Function** to Ohmmeter and **Sensing** to 2-wire or 4-wire, connect the resistor accordingly (§7.1), set the resistance range and start the measurement. The channel sources a current, measures the voltage across the resistor and calculates the resistance from Ohm's law. Use 4-wire sensing for low resistances.

Pulse, sweep and list output

The output is DC by default. To output a pulse, sweep or list, set **AWG** on page 2 accordingly:

- **Pulse:** set the source function, then Pulse Bias, Pulse Peak, Pulse Delay and Pulse Width (§4.3.2).
- **Sweep:** set Sweep Type, Sweep Start, Sweep Stop, Sweep Points or Step, and After Sweep (§4.3.3); on page 3 set the source and measurement trigger counts and periods (§4.4). To see the I–V curve, open the Quick IV page (§6.1).
- **List:** touch Edit, enter the list points, touch Generate for the list to take effect, then Cancel to return to the channel settings (§4.3.4).

Aperture, filter length and time constant

- **Aperture** is the time spent acquiring the signal for one measurement. In DC (non-pulse) operation, aperture time = NPLC / line frequency; a longer aperture gives a more accurate measurement but a slower test.
- **Filter length** (Config page) is the number of readings averaged.
- **LPF-τ** is the low-pass time constant of the output filter: a larger value gives stronger filtering and a smoother output but a slower dynamic response; a smaller value gives a faster response but more noise.

7.3 Reducing interference and improving accuracy

When measuring very small signals, unstable or noisy readings are usually caused by environmental interference. For best results:

- Connect the DUT with direct leads. Do not build the test circuit by clipping probes or Kelvin clips against each other.
- Use triaxial shielded cable or a shield box (for example TH26087B or TH26087E) for low-current measurements.
- Warm the instrument up for at least 60 minutes and operate it away from strong electromagnetic fields and noisy mains supplies.
- For very small ranges, verify accuracy only with proper shielding and interference reduction in place.

CHAPTER 8

Performance & Specifications

Full per-model specifications — source and measurement ranges, resolution and accuracy for voltage, current and resistance, pulse limits, interfaces and environmental data — are given in the **TH199X Series Technical Guide**; refer to it for design-in and quotation purposes. This chapter summarises the operating limits and characteristics that matter when using the instrument.

8.1 Source and compliance

- **Voltage limit / compliance:** accuracy as for the voltage source; minimum value 1 % of the range, or 20 mV on the 200 mV range.
- **Current limit / compliance:** accuracy as for the current source; minimum value 1 % of the range, or 1 nA on the 10 nA range.
- **Four-quadrant operation** (source or sink): ±6 V @ ±3.03 A, ±21 V @ ±1.515 A, or ±210 V @ ±105 mA.
- **Over-range (source):** 105 % of the source range; the 1.5 A and 3 A current ranges are 101 %.
- **Over-range (measurement):** 106 % of the range; the 1.5 A and 3 A current ranges are 102 %.
- **Maximum output power:** 31.8 W.
- **Over-temperature protection:** when an over-temperature is sensed internally, all channel outputs are shut down and the channel that caused it is locked out.
- **Temperature coefficient** (0 °C to 18 °C and 28 °C to 50 °C): ±(0.1 × accuracy specification) per °C.

Output settling times

Output	Range	Settling time to 0.1 % of range (10 % to 90 % step)
Voltage (open circuit)	200 mV and 2 V	< 50 µs
	20 V	< 110 µs
	200 V	< 700 µs
Current (short circuit)	10 nA and 100 nA	< 10 ms
	1 µA	< 500 µs
	10 µA and 100 µA	< 250 µs
	1 mA to 3 A	< 80 µs

8.2 Output range and pulse limits

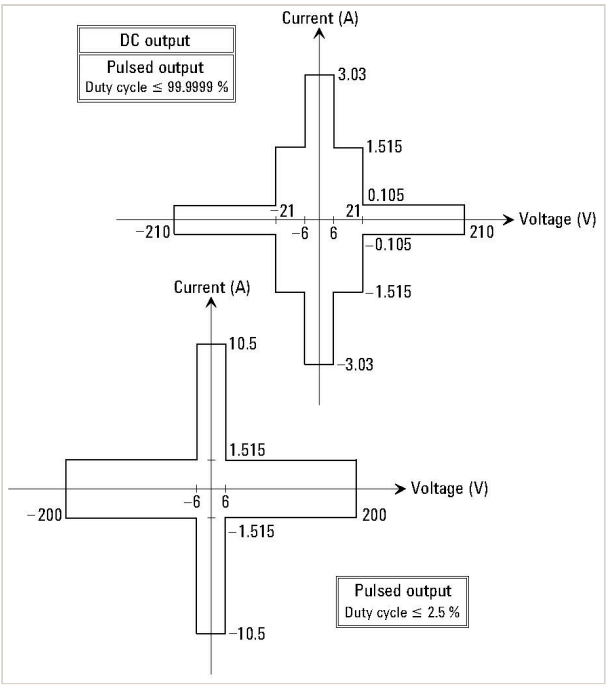

Figure 8-1 Output range (DC or pulse, and pulse only)

Mode	Max. voltage	Max. peak current	Max. base current	Pulse width	Max. duty cycle
DC or pulse	6 V	3.03 A	3.03 A	50 µs – 99999.9 s	99.9999 %
	21 V	1.515 A	1.515 A	50 µs – 99999.9 s	99.9999 %
	210 V	0.105 A	0.105 A	50 µs – 99999.9 s	99.9999 %
Pulse only	6 V	10.5 A	0.5 A	50 µs – 1 ms	2.5 %
	180 V	1.05 A	50 mA	50 µs – 10 ms	2.5 %
	200 V	1.515 A	50 mA	50 µs – 2.5 ms	2.5 %

- Pulse width is the time from the 10 % leading edge to the 90 % trailing edge. Minimum programmable pulse width 50 µs; pulse-width programming resolution 1 µs.
- The pulse source is always measured on a fixed range.
- On dual-channel models the maximum total current of both channels is limited, as shown below.

Total current limit with both channels in use (I1, V1 = channel 1; I2, V2 = channel 2)

V1	V2	Total current limit
±(0 ≤ V1 ≤ 6) V	±(0 ≤ V2 ≤ 6) V	I1 + I2 ≤ 4 A
	±(6 ≤ V2 ≤ 21) V	I1 + I2 × 1.6 ≤ 4 A
±(6 ≤ V1 ≤ 21) V	±(0 ≤ V2 ≤ 6) V	I1 + I2 × 0.625 ≤ 2.5 A
	±(6 ≤ V2 ≤ 21) V	I1 + I2 ≤ 2.5 A

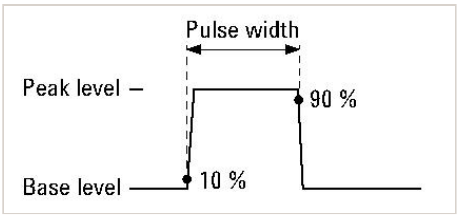

Figure 8-2 Pulse width definition

Minimum pulse width for a stable output (with the stated resistive load)

Source value	Limit value	Load	Stabilization (% of range)	Minimum pulse width
200 V	1.5 A	200 Ω	0.1 %	1 ms
6 V	10.5 A	0.6 Ω	0.1 %	0.2 ms
1.5 A	200 V	65 Ω	0.1 %	2.5 ms
10.5 A	6 V	0.5 Ω	0.1 %	0.2 ms

8.3 Output characteristics

Item	Value
Sense mode	2-wire or 4-wire (remote sensing)
Ground connection	Chassis ground or floating (Low T)
Output position	Channel 1 on the front panel, channel 2 on the rear panel
Maximum capacitive load	0.01 µF (normal mode); 50 µF (high-capacitance mode)
DC floating voltage	±250 V DC maximum between the low terminal and chassis ground
Protection offset voltage (V source)	< 4 mV
Remote-sense operating range	Maximum 3 V between the HI and Sense HI terminals, and between the LO and Sense LO terminals
Common-mode isolation	> 1 GΩ, < 4500 pF
Sense input impedance	> 10 GΩ
Voltage source noise, 10 Hz to 20 MHz (20 V range)	50 mV rms
Voltage source overshoot	< ±(0.1 % + 10 mV) (10 % to 90 % step, resistive load)
Current source overshoot	< ±0.1 % (10 % to 90 % step, resistive load)

8.4 Measurement characteristics

Resistance is calculated as $R = V_{meas} / I_{meas}$ and power as $P = V_{meas} \times I_{meas}$. Automatic resistance measurement uses current-source and voltage-measurement mode; typical performance of 4-wire automatic resistance measurement on the 2 V range is given in the Technical Guide.

For measurement speeds faster than 1 PLC, add the following percentage of range to the accuracy specification:

PLC setting	Voltage range		Current range			
	0.2 V	2 V – 200 V	10 nA	100 nA	1 µA – 100 mA	1 A – 3 A
0.1 PLC	0.01 %	0.01 %	0.1 %	0.01 %	0.01 %	0.01 %
0.01 PLC	0.05 %	0.02 %	1 %	0.1 %	0.05 %	0.02 %
0.001 PLC	0.5 %	0.2 %	5 %	1 %	0.5 %	0.2 %

8.5 Trigger and timing

Item	Value
HANDLER trigger input to trigger output	≤ 1 ms
HANDLER trigger input to source change	≤ 1 ms
Trigger timing resolution	1 µs to 100 ms
Timer accuracy	±50 ppm
Trigger delay	0 to 100,000 s
Trigger events	1 to 100,000
Event stamp	The TIMER value is stored automatically at every triggered measurement.

The minimum time interval of each model is listed in the TH199X Series Technical Guide.

CHAPTER 9

Remote Control Overview

The TH199X series is controlled remotely with SCPI (Standard Commands for Programmable Instruments). Through the RS232C interface a computer can perform almost every operation available on the front panel. Because the command set is large, the full command-by-command reference is published separately as the **TH199X Series SCPI Command Reference**; this chapter covers the remote interfaces, connection procedures and command conventions.

9.1 Remote interfaces

Interface	Notes
RS232C	Standard. DB9 connector; settings under System ▸ RS232/GPIB.
USB device	Standard. USB-B connector; USBTMC or USBCDC mode (System ▸ USB Device).
LAN	Standard. 10/100 Base-T; settings under System ▸ Network.
GPIB	Optional, via the TH26075F GPIB adapter; enabled under System ▸ RS232/GPIB.

The PC software TH199X-001 (TonghuiExpert) and third-party terminal programs can be used over RS232, USB CDC or LAN.

9.2 Connecting to a computer

RS232C

Parameter	Value
Transmission	Full-duplex asynchronous, with start and stop bits
Baud rate	4800 / 9600 / 19200 / 38400 / 115200 bps
Data bits / stop bits / parity	8 / 1 / none
Terminator	NL (line feed, ASCII 10)
Connector	DB9 (minimum three-wire connection: TXD pin 3, RXD pin 2, GND pin 5)

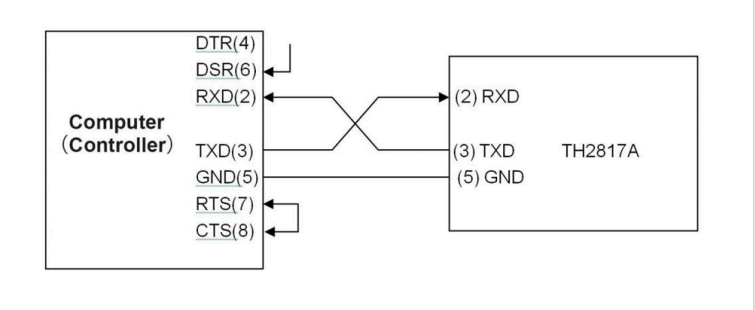

Figure 9-1 Instrument-to-computer RS232 connection

1. Connect the computer and the instrument with a good RS232 cable (or an RS232-to-USB converter cable, installing its driver if required). A self-made three-wire cable should be shorter than 1.5 m; when connecting RS232 to RS232, pins 2 and 3 must be crossed.
2. On the instrument open **System ▸ RS232/GPIB** and set the baud rate (for example 115200).
3. In the serial terminal program select the serial port (if there are several, unplug and re-plug the cable to see which port disappears and reappears) and set the same baud rate.
4. Send `*IDN?` terminated with a line feed (LF, ASCII 10) — the terminator the instrument requires. Many terminal programs send a carriage return plus line feed (CR+LF) by default, which the instrument also accepts. The instrument returns its model and software version and the **Local** lamp on the front panel lights red. If there is no reply, check the settings and the cable.

> **NOTE — RS232 SOFTWARE PROTOCOL**
>
> - The instrument echoes every character it receives; the host should send the next character only after receiving the echo. If no echo is received, check the connection, that the RS232 function is on, and that the instrument is not busy executing a bus command (a character sent meanwhile is ignored and must be re-sent).
> - A command is executed after the NL terminator is received. The instrument sends data only as the echo of received characters and as the reply to a query; replies end with NL.
> - Include only one query in a command string, and read each reply completely before sending the next command. After long-running commands (for example clearing), wait for completion before continuing.

USB device

1. Connect the USB-B port on the rear panel to the computer with a USB cable (TH26017); install the cable's driver if required.
2. On the instrument open **System ▸ USB Device** and select **USB CDC** (select USB TMC only if you use a VISA/USBTMC tool). The instrument prompts for a restart — restart it.
3. The instrument now appears as a virtual serial port. Open it in a serial terminal and send `*IDN?` as above.

LAN

1. Connect the computer and the instrument with a network cable.
2. On the instrument open **System ▸ Network** and read the port number, IP address, subnet mask and gateway address.
3. Configure the computer's IPv4 settings so that: the computer and instrument IP addresses are in the same network segment (first three bytes identical, last byte different); the subnet masks are identical; and the default gateways are identical, with the third byte matching the IP address and the fourth byte normally 1.
4. In a TCP client tool, set the remote IP to the instrument's IP address and port, and the local IP to the computer's address; connect and send `*IDN?`.

Using the TH199X-001 PC software

Open the software, choose **Options ▸ Communication**, select RS232 or USB CDC (and the serial port and baud rate) or Network connection (the instrument's IP address and port), and click **Verify Connection**. When communication is established, the instrument model and version appear at the upper right of the window.

9.3 Command conventions

- Commands are case-insensitive, tree-structured and use English punctuation.
- A single space separates a command from its parameter. No spaces are allowed before or after a colon.
- A command followed by `?` is the query form of that command.
- Commands may be abbreviated or written in full (abbreviations are given in capital letters in the reference, for example `TRIGger` → `TRIG`).
- Several commands on one line are separated by a semicolon; a semicolon followed by a colon restarts from the top of the command tree. Common commands (`*RST`, `*IDN?`, `*OPC`) can be placed anywhere in the line without changing the hierarchy.

Command subsystems

Subsystem	Covers
`:DISPlay`	Display digits, view (single / dual) and displayed parameters
`:FORMat`	Data element format
`:FETCh`	Read back measurement results (array and scalar; current, resistance, time, voltage)
`:MEASure`	Perform a measurement and return the result
`:OUTPut`	Output filter, high-capacitance mode, low terminal, output-off mode, output state and protection
`:READ`	Automatic measurement-data return
`:SENSe`	Aperture, NPLC, protection level, ranging, measured-data read-back, remote sense and measurement function

Subsystem	Covers
`[:SOURce]`	Source level, mode, range, points, start/stop/step, function, list, pulse and sweep parameters
`:SYSTem`	Beeper, LAN / RS232 / USB communication, HANDLER, backlight, power-on state, date and time, version, line frequency
`:TRIGger` / `:INITiate`	Trigger initiation, delay, timer and trigger source signals
`:CALCulate`	Limit (sorting) function
Common commands	`*RST` reset · `*IDN?` identification · `*OPC` operation complete

> **NOTE**
> See the standalone TH199X Series SCPI Command Reference for the full syntax, data ranges and examples of every command in the table above.

CHAPTER 10

Handler Interface

The rear-panel HANDLER interface is a DB25 female connector. It is standard on all TH199X models and is used for:

- trigger input and trigger output;
- digital signal output;
- start-of-test (SOT) input, busy status output and end-of-test (EOT) output for component handlers;
- interlock control;
- high-voltage status output (shared with digital I/O bit 14).

Pin functions are configured on the **System ▸ Digital I/O** page (§6.4); the bin-sorting output patterns are set in the limit test (§5.4).

10.1 Pin assignments

Pin	Signal	Pin	Signal
1	Bit 1	14	Bit 14 or high-voltage status
2	Bit 2	15	GND
3	Bit 3	16	Interlock control [c]
4	Bit 4	17	GND
5	Bit 5	18	GND
6	Bit 6	19	GND
7	Bit 7	20	GND
8	Bit 8	21	GND
9	Bit 9	22	+5 V [a]
10	Bit 10	23	+5 V [a]
11	Bit 11	24	Interlock control [b]
12	Bit 12	25	+5 V [a]
13	Bit 13		

- [a] Current limit 600 mA.
- [b] Interlock control for positive logic — connected to pin 25.
- [c] Interlock control for negative logic — connected to pin 17.

10.2 Internal circuit

The input/output circuit shown below is connected internally to each pin of the HANDLER connector.

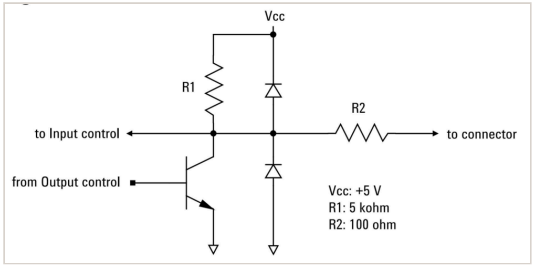

Figure 10-1 HANDLER internal circuit (V_{cc} = +5 V; R1 = 5 kΩ; R2 = 100 Ω)

APPENDIX

Terms, Quick Reference & Contact

A.1 Front-panel key quick reference

Control	Function
CH1 / CH2	Enable / disable channel 1 / channel 2 (yellow = enabled, red = high-voltage state)
Trigger	One measurement; stops repeated measurements
Auto	Repeated measurements; stops them if running
Local	Return from remote to local control
Knob	Turn to change a value or move a marker; press to confirm
POWER	Instrument on / off
Page menu	Home · Config · Quick IV · Expert · File · System

A.2 Terms

Term	Meaning
Compliance (limit)	The limit on output current (voltage source) or output voltage (current source) that protects the DUT.
Force / Sense	Force terminals drive the current; Sense terminals sense the voltage at the DUT (4-wire measurement).
Guard	Driven shield conductor at the potential of the force conductor; reduces leakage current.
Four-quadrant	The channel can both source and sink current, at positive and negative voltage.
Aperture	Time spent acquiring the signal for one measurement.
NPLC / PLC	Number of power-line cycles over which a measurement is integrated (aperture time = NPLC / line frequency).
Filter length	Number of readings averaged in the Config filter.
LPF-τ	Time constant of the source output low-pass filter.
High C	High-capacitance mode for capacitive loads from 0.01 µF up to 50 µF.
AWG	Source output waveform: DC, Pulse, Sweep or List.

A.3 Contact, warranty and support

Warranty: two years from delivery, per §1.7. For service, calibration, accessories or any question about this manual, contact Techmize or your authorized distributor using the details below.

Techmize Electronic GmbH

Office 125–126, Regus
Carl-Zeiss-Ring 15a, 85737 Ismaning,
Germany
An international subsidiary of Changzhou
Tonghui Electronic Co., Ltd. (China)

Contact

Mobile: +49 171 4981898
Email: dx.han@tonghui.com.cn
Web: en.tonghui.com.cn

Registration

Managing Director: Haohua Zhao
Register Court: Amtsgericht München
HRB 312530 · VAT ID DE463170824